May 31, 2007

Lodgeworks
Attention: Michael Frey
8100 E 22nd Street, Building 500
Wichita, KS 67226

REMEDIAL ACTION WORKPLAN
PETROLEUM HYDROCARBON CONTAMINATION
INN AT TOWN CENTER SITE
Northwesterly Corner of First and Franklin Streets
Napa, California
Raney Reference No. 2952-001.02

INTRODUCTION

In accordance with your request, we have prepared this *Remedial Action Workplan* (RAW) for remediation of petroleum hydrocarbon-impacted soils and groundwater at the subject property. The approximate three-quarter-acre vacant site is situated northwesterly of the intersection of First and Franklin Streets in Napa, California. Environmental investigations have revealed that soil and groundwater beneath the site contain significant concentrations of predominantly gasoline-range petroleum hydrocarbons; the source of the contamination is thought to be a gasoline station that previously occupied the northerly adjacent site. The purpose of the planned remedial work at the subject property is to reduce the potential risk to human health prior to construction of a proposed hotel on the site. It has recently been determined that the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) will act as the lead agency for oversight of remediation of the contamination beneath the site.

Included herein is: a brief description of the property; a summary of past environmental investigations and site characterization; discussion regarding the nature and extent of contamination; discussion regarding remedial objectives and the remedial approach; a description of the proposed remedial implementation procedures; and, a description of proposed confirmation sampling, monitoring well installation, and reporting. At our firm's direction, Environmental Resources Management (ERM) performed a *Health Risk Assessment* (HRA) to evaluate the current health risk posed by the petroleum hydrocarbon contaminants beneath the site, and to develop risk-based concentrations in support of proposed remedial actions. The risk assessment included a statistical analysis of the available data and a quantitative evaluation of potential risks to future commercial receptors.

3140 BEACON BLVD., WEST SACRAMENTO, CA 95691 -PHONE (916) 371-0434 - FAX (916) 371-1809

A *Vicinity Map* showing the location of the subject property is presented as Plate 1. A *Plot Plan* showing the property boundaries, nearby site usage, relevant features, and exploratory borings locations is presented as Plate 2. Plates 3 and 4 show the approximated lateral extent of soil and groundwater contamination beneath the site, respectively. Plate 5 is a site plan showing the general areas of proposed remedial work, and Plate 6 shows a profile view of the proposed remedial area. Soil and groundwater analytical data from the site are summarized on Tables I and II, respectively. The HRA report is presented in Appendix A, and an *Environmental Health and Safety Plan* for the remedial activities is presented in Appendix B.

SITE IDENTIFICIATION INFORMATION

Identification information for the subject property is listed below:

Site Name: Inn at Town Center Property

Site Address: 1400 First Street, Napa, Napa County, California

***Assessor's Parcel Number*:** APN 330-198-024

The agencies, firms, and individuals involved with environmental assessment and remediation of the property are listed below along with the responsibilities of each and their phone numbers.

Agency / Firm	***Responsibility***	***Contact***	***Phone Number***
Lodgeworks/Napa Sierra Associates, LP	Owner/Developer	Mike Frey	(316) 640-1005
San Francisco Bay Region Water Quality Control Board (SFBRWQCB)	Lead Environmental Agency	Ralph Lambert	(510) 622-2382
Napa County Department of Environmental Management (NCDEM)	Local Environmental Agency	Joel Coffman	(707) 253-4471
Environmental Resources Management (ERM)	Toxicology/Risk Assessment Consulting	Mark Bowland	(916) 924-9378
Raney Geotechnical, Inc.	Geologist/Site Characterization/ Remediation Oversight/ Clearance Sampling	Joe Brusca	(916) 371-0434
To be determined	Remediation Contractor	----	----

SITE DESCRIPTION AND HISTORICAL INFORMATION

The approximate three-quarter-acre subject property is situated northwesterly of the intersection of First and Franklin Streets in Napa, California. The site is bordered to the north by a multi-story City parking garage, and to the west by a building that is occupied by a health and fitness facility (Exertec). The property is bordered to the south and east by First Street and Franklin Street, respectively. The generally layout of the property and immediate vicinity is shown on Plate 2, Plot Plan.

Previous commercial buildings at the site were demolished late last year and the site is currently vacant and unused. The surface of the site is covered with a layer of gravel that evidently is remnant of the demolition operations. Temporary construction fencing is in place along the easterly and southerly margins of the property (at the back of sidewalks along the adjacent roadways). We understand that construction of a five-story hotel structure on the property is planned; the footprint of the proposed structure is shown on Plate 2. The proposed building is anticipated to be of concrete and steel construction, with a concrete slab-on-grade lower floor. Below grade construction is expected to be limited to foundations, underground utilities, and an elevator pit.

We conducted historical research (including review of a 2005 Phase I study, aerial photographs, Sanborn Fire Insurance Maps, historical directories, and agency records) to evaluate past use of the property.[1] Our research indicates that the subject property supported residences as early as the late 1800s and that the property apparently was used as a parking lot and automobile sales lot (Moffit Motors Used Cars) for a period of time around 1953 through 1959. Commercial buildings (including a J.C. Penney Department Store) apparently were constructed on the site in the early 1960s; the first directory listing for the J.C. Penny store was in 1965. The commercial buildings were occupied by a number of different retail businesses, none of which would be expected to have used or stored petroleum hydrocarbons. The on-site commercial structures were demolished late last year. Our historical research did not reveal any evidence of use of underground fuel storage tanks on the property, or any other past use of the subject site that would have contributed to the petroleum hydrocarbon contamination beneath the property.

Our research indicates that a gasoline station/automobile service facility operated on the northerly adjacent property (site currently occupied by a multi-story parking garage) from about 1942 until the mid-1970s. The general location of the former automobile service shop and the former fuel dispenser/underground tank area are shown on Plate 2. Napa Fire Department records indicate that new underground gasoline tanks were installed at this site near the intersection of Franklin and Clay Streets around 1964; a permit for the removal of these tanks was processed in 1975. Our research has not revealed any evidence that subsurface conditions have ever been investigated at the northerly adjacent site; the former gasoline station site does not appear on agency listings of known contaminated sites.

[1] Ransom Environmental Consultants, Inc.; "Phase I Environmental Site Assessment, 1440, 1430, and 1460 First Street, 1001 Franklin Street, Napa, California"; June 3, 2005.

SURROUNDING LAND USE

The subject property is situated within a historic downtown area of Napa that has mostly been redeveloped. Nearby property use is predominantly for commercial purposes (see Plate 2). The adjacent property to the north supports a multi-story parking garage, and the adjacent property to the west supports a building occupied a health and fitness facility (Exertec). Properties across adjacent roadways support predominantly commercial (office and retail) land use. Construction is on-going at a nearby site (Napa Square) southerly of the subject property across First Street; current construction activities at this site include groundwater dewatering to facilitate basement construction. We understand that permanent dewatering systems will operate at the Napa Square site following construction.

We have not identified any sensitive land use (such as schools, day-care facilities, or residential use) on properties adjacent to or very near the subject property.

GEOLOGIC AND HYDROLOGIC SETTING

Geology

The subject property is located in the Napa Valley within the Coast Ranges Geomorphic Province of California. The Coast Ranges generally consist of an alternating series of parallel mountains and valleys located adjacent to the Pacific Coast. The northern Coast Ranges are composed primarily of Mesozoic and Cenozoic deposits that have undergone complex episodes of sedimentation, erosion, volcanism, folding, faulting and uplift. Geologic mapping indicates that the vicinity of the subject property is underlain by Quaternary alluvium deposited by the Napa River system.

Soils

Beneath shallow surface fills, our exploratory borings on the subject property encountered relatively heterogeneous alluvial deposits comprised predominantly of very clayey silts and silty clays. The deposits generally graded less clayey with depth; sandy silts and silty sands typically were encountered below depths of about 15 feet. Sparse to abundant gravel was encountered within the subsurface deposits locally. A prominent discontinuous gravelly deposit was encountered between depths of about six to 12 feet beneath the north-central portion of the property (in the vicinity of Borings B6, B11, B12, and B13).

Hydrogeology

Our exploratory borings have revealed variable groundwater conditions beneath the site. Groundwater was encountered in our February and April 2007 borings at depths ranging from about eight to 20 feet. Stabilized groundwater depths within the borings ranged from three to 19 feet. The shallowest groundwater conditions generally appeared to be coincident with the above-mentioned discontinuous gravelly deposit beneath the north-central portion of the site. We noted that, in general, groundwater stabilized at deeper levels in our April 2007 borings compared to the stabilized levels in the borings performed in February 2007. This disparity may be due to seasonal groundwater fluctuations; however, it may also be related to construction dewatering that is ongoing at the Napa Square project southerly of the subject property across First Street.

PAST ENVIRONMENTAL INVESTIGATIONS

Ransom Environmental Consultants, Inc., *Phase I Environmental Site Assessment*

Ransom Environmental Consultants, Inc. prepared a *Phase I Environmental Site Assessment* of the subject property in 2005. The *Phase I Environmental Site Assessment* indicates that the subject property supported residences as early as the late 1800s and that the property apparently was used as a parking lot and automobile sales lot for a period of time around 1950. Commercial buildings (including a J.C. Penney Department Store) reportedly were constructed on the site in the early 1960s. The referenced 2005 Phase I study did not indicate known contamination conditions on the subject site, nor any past use of the subject property that likely would have resulted in subsurface contamination. However, the Phase I study identified that a gasoline station previously operated on the northerly adjacent property (site currently occupied by the multi-story City parking garage). The Ransom study suggested the performance of screening sampling to determine if the past activities at the nearby former gasoline station resulted in contamination of soils and/or groundwater beneath the subject site.

Wallace-Kuhl & Associates, Soil Sampling/Analysis

In 2006, Wallace-Kuhl & Associates documented that a geotechnical boring on the northerly portion of the subject site encountered petroleum hydrocarbon contaminated soils.[2] A soil sample collected from a depth of 6.5 feet was submitted for laboratory analysis; this sample reportedly contained 500 milligrams per kilogram (mg/kg) total petroleum hydrocarbons (TPH) as gasoline and 0.99 mg/kg benzene, as well as detectible concentrations of other gasoline constituents. The limits and source of the petroleum hydrocarbon contamination were not determined at that time. Wallace-Kuhl & Associates suggested that it was likely that groundwater beneath the site had been impacted with petroleum hydrocarbons based on reported seasonal high groundwater depths.

Raney Geotechnical, Inc., Subsurface Investigation

Earlier this year, our firm collected soil and groundwater samples from direct push borings (B1 through B13) at the site to evaluate the nature and extent of petroleum hydrocarbon contamination; the results were presented in reports dated March 7, 2007

[2] Wallace-Kuhl & Associates; "Report of Findings, Soil Sampling and Analysis, Inn at Town Center, Napa, California"; November 14, 2006.

and April 27, 2007.[3] [4] The data gathered earlier this year indicate that significant petroleum hydrocarbon contamination exists beneath the northerly portion of the site. The lateral extent of significant shallow soil contamination was indicated to be limited; however, it appeared that groundwater contamination extends beneath a larger portion of the property.

NATURE, EXTENT, AND SOURCE OF CONTAMINATION

Our referenced investigations have resulted in reasonable characterization of the nature and extent of the petroleum hydrocarbon contamination beneath the site. The soil and groundwater analytical data generally indicate predominantly weathered gasoline-range petroleum hydrocarbons as the primary contaminant. None of the samples tested contained MTBE or other fuel oxygenates at concentrations above the laboratory reporting limits. No metals were detected in soil samples at concentrations above expected background (naturally-occurring) ranges.

The maximum concentration of TPH as gasoline detected in soil samples collected by our firm is 270 mg/kg. It is noted that a soil sample collected by Wallace-Kuhl & Associates contained 500 mg/kg TPH-g. The maximum detected concentrations of benzene, toluene, ethylbenzene, and xylenes in our soil samples were 1.0 mg/kg, 2.4 mg/kg, 3.9 mg/kg, and 13.4 mg/kg, respectively.

The maximum concentration of TPH as gasoline detected in groundwater beneath the site is 1,300,000 micrograms per liter (ug/L). This concentration was measured in the sample collected from Boring B6, and is indicative of free product in this area. The maximum detected concentrations of benzene, toluene, ethylbenzene, and xylenes in groundwater samples were 870 ug/L, 360 ug/L, 7,000 ug/L and 4,540 ug/L, respectively.

The inferred general limits of soil and groundwater contamination are shown on Plates 3 and 4, respectively. As shown, the soil contamination appears to be limited to the north-central portion of the site (within the vicinity of Borings B6, B11, B12, and B13). Groundwater contamination extends beneath a larger portion of the site. The highest concentrations of soil and groundwater contamination appear to be coincident with more gravelly/permeable deposits beneath the north-central site area (vicinity of Borings B6, B12, and B13). It is likely that this apparently discontinuous deposit has acted as a preferential pathway for contaminant migration.

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[3] Raney Geotechnical, Inc.; "Subsurface Investigation – Evaluation of Petroleum Hydrocarbon Contamination, Inn at Town Center Site, Northwesterly Corner of First and Franklin Streets, Napa, California"; March 7, 2007; Reference No. 2952-001.01.

[4] Raney Geotechnical, Inc.; "Additional Site Characterization – Evaluation of Petroleum Hydrocarbon Contamination, Inn at Town Center Site, Northwesterly Corner of First and Franklin Streets, Napa, California"; April 27, 2007; Reference No. 2952-001.01.

Given the available historical information, as well as the distribution of soil and groundwater contamination beneath the site, the petroleum hydrocarbon contamination detected beneath the subject site likely is related to the former gasoline station that operated on the northerly adjacent property prior to construction of the existing parking garage.

HEALTH RISK ASSESSMENT

At our firm's direction, Environmental Resources Management (ERM) performed a *Health Risk Assessment* (HRA) to evaluate the baseline health risk to future potential site receptors posed by the petroleum hydrocarbon contaminants beneath the site, and to develop risk-based concentrations in support of proposed remedial actions. The risk assessment included a statistical analysis of the available data and a quantitative evaluation of potential risks to future potential commercial receptors. The HRA generally followed United States Environmental Protection Agency (USEPA) and California Department of Toxic Substances Control (DTSC) risk assessment methodologies and assumptions. The HRA report is presented in Appendix A. As described in the appended report, the assumptions, values, and methodologies used in the HRA and calculation of risk-based clean-up concentrations are considered conservative. Theoretical risks predicted by the assessment likely overestimate the actual risk.

Based on anticipated site usage, three receptor types were evaluated in the HRA: construction workers, outdoor maintenance workers, and commercial (hotel) workers. The results of the HRA indicate that theoretical exposures to contaminants in groundwater beneath the site are above acceptable metrics. The primary exposure pathways exhibiting the greatest calculated risks are indicated to be dermal contact with groundwater (such as during construction or future maintenance activities) and volatilization of organic compounds in groundwater and intrusion into indoor air. The chemicals contributing the greatest estimated risks were identified as TPH as gasoline, benzene, and 1,2,4-Trimethylbenzene. Because the groundwater beneath the site is not currently nor intended for future domestic use, exposures associated with beneficial uses of groundwater were not assessed.

The HRA included the calculation of risk-based concentrations of petroleum hydrocarbon contaminants considered protective of the future potential receptors. Based on the calculated risk-based concentrations, target clean-up values have been established that are protective of future workers at the site.

REMEDIAL OBJECTIVES AND REMEDIAL APPROACH

General

Based on the results of the HRA and preliminary discussions with regulatory agency representatives, remedial efforts to reduce the potential risk to human health and the environment appear warranted. As described above, contaminants in groundwater theoretically pose an unacceptable health risk to future workers on the property.

We understand that performance of the remedial work in the very near future is necessary to accommodate the schedule for construction of the proposed hotel on the site. As such, remedial decision-making has been made without the benefit of long-term groundwater monitoring data, full engagement of the lead regulatory agency, or an official determination of the “responsible party” for the petroleum hydrocarbon contamination. Given the available information, the status of the site, and the construction schedule, a generally conservative remedial approach is considered prudent; once the site is redeveloped it may be impractical or very difficult to implement efficient remedial measures. Further, it will be necessary to confirm the effectiveness of the remedial efforts prior to hotel construction and occupancy; as such, long-term remedial approaches are not viable given Lodgeworks’ objectives. Based on the site conditions and the planned development of the property, performance of a contaminant-removal excavation is considered the most expeditious and practical approach for remediation of subsurface contaminants prior to construction of the proposed hotel. In addition to the removal of contaminated soils and groundwater, we also suggest the installation of a subsurface cut-off wall to minimize any future migration of contaminants from the northerly property to the subject site.

Following excavation of contaminated soils and pumping of contaminated groundwater from the excavation, residual contaminant concentrations should be evaluated. Based on the residual conditions, additional remedial measures such as enhanced bioremediation and/or soil vapor control may be warranted.

Target Clean-up Values

As described earlier in this report, ERM performed a *Health Risk Assessment* to evaluate the health risk posed by the petroleum hydrocarbon contaminants beneath the site, and to develop risk-based concentrations in support of proposed remedial actions. Risk-based concentrations considered protective of the future potential receptors were calculated for petroleum hydrocarbon contaminants in soil and groundwater utilizing a target cancer risk of $1x10^{-6}$ for benzene and a target hazard quotient of 0.5. Based on the analysis, the following clean-up values are indicated to be protective of outdoor maintenance workers and indoor (hotel) workers:

Medium	*Chemical*	*Target Clean-up Concentration*
Soil	Benzene	0.41 mg/kg
Groundwater	TPH-gasoline	30,000 ug/L
Groundwater	Benzene	112 ug/L
Groundwater	1,2,4-Trimethylbenzene	5,292 ug/L

The risk-based concentrations analysis indicates that the above listed clean-up values may not be entirely protective of construction workers, however it is noted that the analysis indicates that nearly all of the construction worker hazard is associated with the highly uncertain assessment of the dermal contact with groundwater pathway. Our understanding of the proposed construction at the site indicates that only very limited portions of the site construction have the potential to involve dermal contact with groundwater; significant dermal contact with groundwater during construction is expected to be negligible. As such, we recommend that the risk to construction workers be managed by the development and implementation of construction safety measures to prevent or minimize dermal contact with groundwater.

Contaminant Removal Excavation

In order to accomplish removal of petroleum hydrocarbons from the subsurface within a short period of time (i.e. prior to hotel construction), we recommend the performance of a contaminant-removal excavation in the area where groundwater concentrations exceed the target clean-up values. Contaminated vadose zone and saturated soils from this area should be removed from the site for proper disposal. Subsequently, contaminated groundwater could be removed by the performance of direct pumping from the open excavation.

Because of the adjacent multi-story parking garage, it will not be practical to extend the contaminant-removal to the northerly property line; the excavation should be set back from the parking garage so that foundation support of the parking structure is not jeopardized. It is fortunate that the lower floor of the proposed hotel on the subject property will be set back about 25 feet southerly of the parking garage; from a health-risk standpoint, it likely would be acceptable to leave some petroleum hydrocarbon contaminated materials in place beneath the far northerly margin of the site. If necessary, future remedial work (such as groundwater removal or treatment) could be performed on the far northerly portion of the site or beneath the northerly adjacent parking garage.

Subsurface Cut-Off Wall

Because it is indicated that the source of the petroleum hydrocarbon is situated northerly of the property (beneath the parking garage), construction of a subsurface cast-in-place concrete cut-off wall to minimize any future migration of contaminants from the northerly property to the subject site is warranted. We suggest that the cut-off wall be installed to a depth 12 feet along nearly the entire northerly property margin. The wall should be set back from the parking garage so that foundation support of the parking structure is not jeopardized during excavation for the subsurface wall.

It should be recognized that, in the absence of long-term groundwater monitoring data (including characterization of groundwater flow and gradient conditions), installation of a subsurface cut-off wall presents a risk of altering groundwater flow conditions resulting the redirection of contaminants toward adjacent properties (i.e. to the east or west of the cut-off wall). We recommend the installation of groundwater monitoring wells at the ends of the cut-off wall so that groundwater conditions in these areas could be monitored in the future. Should groundwater monitoring data demonstrate that altered groundwater flow conditions result in potential risk to adjacent sites, remedial efforts northerly of the cut-off wall may be necessary. Further, we suggest that the regulatory agencies and the owner of the northerly adjacent property be encouraged to consider conducting investigation and possible remediation within the suspected contamination source area (the former gasoline station) northerly of the subject property.

Evaluation of Residual Contaminants in Groundwater and Possible Additional Remedial Measures

Site characterization data indicate that the petroleum hydrocarbon contaminants occur primarily within groundwater beneath the site, and the contaminants in groundwater pose a health risk to future workers on the property. Removal of petroleum hydrocarbons at and below the groundwater table from an open excavation can be inefficient, and it is difficult to predict the post remediation level of residual contaminants in saturated soils. Following excavation of soils and pumping of groundwater, we recommend collection of clearance soil samples and grab groundwater samples from the open excavation; based on the results of the soil and groundwater sampling, further groundwater remediation via enhanced bioremediation may be warranted. Enhanced bioremediation (if necessary) could consist of the emplacement of a product such as Oxygen Release Compound (ORC) into groundwater. Specifics regarding any enhanced bioremediation efforts (such as the type and amount of product to use) should be based on the conditions exposed in the excavation, and the results of soil and groundwater sampling conducted within the excavation.

Additionally, groundwater monitoring wells should be installed following performance of the contaminant removal work and implementation of any enhanced bioremediation. Based on groundwater monitoring data, further remedial efforts to prevent or minimize soil vapor intrusion into the proposed hotel building may be warranted. Soil vapor control measures could include use of an under-slab gas vapor membrane (such as Liquid Boot®) and/or sub-slab vapor venting.

PUBLIC PARTICIPATION

Our recent discussions with Ralph Lambert of the SFBRWQCB indicate that a public participation process will be required prior to implementation of the remedial work at the site. Mr. Lambert has indicated that public participation must include preparation of a *Fact Sheet* that briefly describes the site conditions and proposed remedial activities. The SFBRWQCB will require that the *Fact Sheet* be distributed to “interested parties” (such as the City of Napa) and property owners within at a 500-foot radius of the subject site. The case will subsequently be open for public comment for a 30-day period prior implementation of the remedial work.

REMEDIAL ACTION IMPLEMENTATION

General

We propose remedial removal of soil and groundwater beneath the north-central portion of the property. We also suggest the installation of a subsurface cut-off wall, and potentially enhancing biodegradation via the emplacement of a product such as Oxygen Release Compound into the remedial excavation. Notification of the remedial work schedule should be provided to the applicable agencies, and our firm should provide oversight and clearance sampling during the work. Remedial soil and groundwater removal and disposal should be performed by a licensed hazardous materials contractor. Excavated soils and groundwater should be properly handled, manifested and disposed in accordance with applicable regulations. The contaminant-removal excavation should be restored to grade with clean backfill materials approved by our firm. Following the remedial work, groundwater monitoring wells should be installed to evaluate the effectiveness of the remediation, and to evaluate conditions at the ends of the subsurface cut-off wall. Based on the results of post-remediation groundwater monitoring, vapor control measures such as us of a sub-slab vapor membrane and/or sub-slab venting may be in order.

Health and Safety Plan

A generalized *Environmental Health and Safety Plan* for the remedial activities is presented in Appendix B. It will be the contractor's responsibility to develop a Health and Safety Plan specific to their work. It will also be the contractor's responsibility to implement environmental and physical safety measures to protect on-site workers during the work.

Scheduling and Notification

The scheduling of the remedial work should be coordinated with the property owner and our firm. The SFBRWQCB and the NCDEM should be notified at least one week prior to initiation of remedial activities at the site. Additionally, written notice should be provided to the Bay Area Air Quality Management District (BAAQMD) in accordance with BAAQMD Regulation 8 Rule 40.

Utility Clearance/Permits

The locations of any underground utilities at the site should be determined and marked so that damage to any utilities can be avoided during remedial excavation. The planned excavation areas should be marked for Underground Service Alert clearance. The contactor also should contact the applicable agencies to determine if a grading permit is required for the remedial soil excavation.

Site Access, Staging, and Site Security

Prior to the remedial work, appropriate site access routes for equipment, trucks, etc. should be determined. Currently, the site is accessed via an alley at the northwest corner of the property; this drive aisle passes near of the entrance to the adjacent health and fitness facility and may not be appropriate for heavy truck traffic. Site access from Franklin Street or First Street should be considered; however, access to these roadways may require implementing some traffic control measures. The access routes for the remedial work should be approved by the property owner.

It would appear that there is ample site area for temporary remedial equipment storage/staging and for the stockpiling of excavated soils. Appropriate equipment staging areas and soil stockpiling areas should be established prior to initiating the work, and should be approved by the property owner.

The site currently is secured with temporary chain-link fencing. The site should be maintained in a secure condition during the remedial work to prevent unauthorized access to the property.

Site Clearance and Marking of Remedial Areas

Prior to remedial soil excavation, any debris, equipment or stored materials should be removed from the planned work areas. The location of the proposed cut-off wall and the general area of the planned contaminant removal excavation should be marked. The layout of the work should be reviewed and approved by our firm prior to installation of the subsurface cut-off wall or any excavation activities.

Subsurface Cut-off Wall

To minimize future migration of contaminants from the north, a 12-foot deep subsurface cast-in-place concrete cut-off wall should be constructed at the location shown on Plate 5. The cut-off wall should be installed prior to performance of the contaminant removal excavation. As shown, the main portion of the cut-off wall should be situated about 15 feet southerly of the adjacent parking garage structure. The cut-off wall should be constructed within a minimum 18-inch wide trench excavation. Our firm should observe excavation for the cut-off wall; it may be necessary to adjust the location and/or depth of cut-off wall based on the conditions encountered during excavation. Soils generated during cut-off wall excavation should be segregated; obviously contaminated soils should be stockpiled separately from soils that are apparently clean. All stockpiled soils should be managed in accordance with the procedures described below in the *Contaminant Removal Excavation* section below.

We expect that groundwater will be encountered in the cut-off wall excavation; groundwater should be pumped from the excavation immediately prior to concrete placement. Pumped groundwater from this area is expected to contain petroleum hydrocarbons, and should be appropriately containerized and stored on site pending disposal.

Cut-off wall concrete should be placed on the same day of excavation. We suggest that a minimum four-sack concrete mix be used; our firm should review the concrete mix design prior to cut-off wall construction. If it is not possible to remove nearly all of the water from the cut-off wall excavation prior to concrete placement, it may be necessary to tremmie-place the concrete. In general, we recommend that cut-off wall concrete be placed to a level about three feet below existing site grades. However, we suggest that plans for the proposed hotel be reviewed to ensure that the subsurface cut-off wall does not conflict with proposed subsurface construction (such as foundations or underground utilities); it may be necessary to adjust the top elevation of the cut-off wall locally.

Contaminant Removal Excavation

The general area of the proposed contaminant removal excavation is shown on Plate 5; the actual limits of the excavation will be based on the conditions encountered and should be determined by our representative during excavation. The intent of the excavation would be to sufficiently remove contaminated soils and groundwater such that the residual contaminant concentrations do not exceed the target clean-up values.

Exploratory data indicate that the primary depth interval of petroleum hydrocarbon contamination in the proposed excavation area is between about five and ten feet; we anticipate the maximum excavation depth will be on the order of 12 feet. Excavation should be performed using appropriate equipment such as a backhoe or excavator. We expect that groundwater will enter the excavation and stabilize at a depth on the order of five to seven feet below existing ground surfaces (assuming that excavation is performed prior to the rainy season). Remedial soil excavation should commence at the location of known highest concentrations of petroleum hydrocarbons in groundwater (near our Boring B6 location) and should be extended vertically and laterally until reasonably clean conditions are engaged as determined by our representative. For excavation sidewall stability, it may be necessary to slope portions of the excavation margins; decisions regarding excavation sidewall configuration should be determined in the field based on the conditions encountered. Care should be exercised during excavation adjacent to the cast-in-place concrete subsurface cut-off wall so that the wall is not damaged by the excavation activities. The final limits of the excavation should be based on our observations and the results of confirmation sampling. It will be the responsibility of the remediation contractor to implement appropriate excavation safety and security precautions.

Excavated soils should be placed on visqueen within the designated stockpile areas. Excavated apparently “clean” soils should be stockpiled separately from obviously contaminated soils. Soils shall be transported from the removal area to the designated stockpile areas in a manner that prevents spillage onto site surfaces. In order to control dust and fugitive soils during the remedial activities stockpiled soils should be wetted as necessary and covered with visqueen. The visqueen should be secured as necessary to prevent wind disturbance.

The remedial excavation activities should be scheduled for a period when rainfall is not anticipated. If rainfall occurs during excavation, controls (such as perimeter berms) should be implemented to prevent storm water discharge from the remedial areas and stockpiled soils.

Groundwater Removal and Disposal

We expect that groundwater will accumulate within the proposed remedial excavation. Groundwater should be pumped from the excavation as directed by our firm. At a minimum, two episodes of groundwater pumping should be performed. Our firm will collect grab groundwater samples from the open excavation for laboratory testing following pumping episodes. Decisions regarding additional groundwater pumping from the excavation will be based on the laboratory data. Pumped groundwater should be properly stored in an enclosed container (such as a Baker Tank) on site pending profiling and disposal facility acceptance. Care should be exercised during groundwater pumping activities so that all pumped water is containerized, and none is discharge to the site surface. Following profiling and acceptance, the containerized groundwater should be removed from the property and properly hauled to the accepting disposal facility. Groundwater disposal manifests should be provided to the property owner.

Confirmation Sampling/Analysis

Following excavation, soil samples should be collected from the limits of the excavation. We anticipate the collection of several sidewall samples and excavation bottom samples; the actual number of clearance soil samples should be determined by our firm in the field and should be based on the size of area excavated, as well as the conditions exposed in the excavation. The clearance soil samples should be collected in accord with standard environmental sampling protocol, and should be submitted to a State-certified laboratory for analysis for TPH as gasoline and BTEX. Conditions encountered/observed at the sampling locations should be documented and a site map showing the numbering of the sampling locations should be prepared. Based on the results of the clearance sample soil analyses, additional excavation may be deemed necessary.

Additionally, as mentioned above, grab groundwater samples should be collected from the open excavation during and following episodes of groundwater removal. The grab groundwater samples should be collected in accord with standard environmental sampling protocol, and should be submitted to a State-certified laboratory for analysis for TPH as gasoline, and BTEX, and 1,2,4-trimethlybenzene.

Stockpile Sampling and Landfill Acceptance

An appropriate number of samples should be collected from the segregated stockpiles of "apparently clean" and "obviously contaminated" soils generated during cut-off wall construction and remedial excavation. At a minimum, we recommend the collection of one four-part composite soil sample per 200 cubic yards of stockpiled soils. The samples of stockpiled soils should be collected in accord with standard environmental sampling protocol and should be submitted to a State-certified laboratory for analysis for TPH as gasoline and BTEX. The landfill may require additional analyses for acceptance purposes. The contractor should arrange for acceptance of the excavated/stockpiled soils at an appropriate permitted landfill facility. Following acceptance, the stockpiled contaminated soils should be completely removed from the property and properly hauled to the accepting landfill facility. The remediation contractor should provide the disposal manifests to the property owner. Stockpiled soils that are determined to be clean may be used to backfill the contaminant removal excavation.

Groundwater Treatment/Enhanced Bioremediation

As described above, our firm will collect grab groundwater samples from the open remedial excavation for laboratory analysis following episodes of groundwater pumping. If, following groundwater pumping efforts, groundwater samples contain the chemicals of concern at concentrations above the target clean-up values, groundwater should be further remediated via placement of a product such as Oxygen Release Compound (ORC) to enhance biodegradation of petroleum hydrocarbons in groundwater. ORC is a formulation of magnesium peroxide that time releases oxygen to enhance bioremediation of petroleum hydrocarbons in groundwater; naturally occurring aerobic microbes degrade the hydrocarbons into non-toxic by-products. The ORC could be placed into the contaminant removal excavation prior to excavation backfilling. Our firm would develop specifics regarding any enhanced bioremediation efforts (such as the type and amount of product to use) at the time of the remedial work should such efforts be determined to be necessary.

Excavation Backfilling and Site Restoration

Following approval by our firm, the contaminant removal excavation should be backfilled to pre-excavation grades. Immediately prior to backfill placement, groundwater should be pumped from the excavation to the extent practical, and any loose or disturbed soils should be removed from the base of the excavation at our representative’s direction. The lower portion of the excavation (below the groundwater level) should be backfilled with granular “self-compacting” materials (pea gravel or ¾-inch crushed rock). To prevent unwanted migration of fines, filter fabric (Mirafi 140N or approved equivalent) should be placed to completely surround gravel material used as backfill. Subsequently, the remainder of the excavation should be backfilled with mechanically compacted engineered fill. Care should be exercised during backfill placement and compaction to avoid damage to the cast-in-place concrete subsurface cut-off wall.

All materials used for backfilling should be approved by our firm prior to the work. Backfill materials should be brought to a uniform near-optimum moisture content and placed in the excavation in eight-inch lifts. Backfill should be compacted to at least 95 percent of the ASTM D1557-02 maximum dry density. Backfill placement and compaction should be performed in accord with the earthwork recommendations presented in the *Geotechnical Investigation* prepared for the site by our firm dated

February 2, 2007.[5] Additionally, geotechnical review should be performed to determine whether modified foundation recommendations are warranted for the portion of the proposed hotel structure that overlies the backfilled remedial excavation.

Installation of Groundwater Monitoring Wells

We propose installation of three groundwater monitoring wells on the property in conjunction with the remediation work. Monitoring Well MW1 is proposed to be installed within the area of the contaminant removal excavation; this well would be used to evaluate and monitor residual petroleum hydrocarbons in groundwater following the soil and groundwater removal activities. Monitoring Wells MW2 and MW3 are proposed to be installed at the westerly and easterly ends of the proposed subsurface cut-off wall to evaluate groundwater conditions at these locations in the future. The locations of the proposed monitoring wells are shown on Plate 5.

Prior to installation of the monitoring wells, the necessary Well Permits should be obtained through the Napa County Department of Environmental Management. The groundwater monitoring wells could be drilled/installed using a conventional truck-mounted drill rig. The two-inch diameter wells should extend to depths of about 20 feet and the lower approximate 17 feet of the wells should be screened. A flush-mounted well head vault should be installed at the surface at each well, and each of the wells should be protected with a locking cap.

The wells should be developed following installation and the tops of the well casings should be surveyed for location and elevation by a licensed land surveyor. Development (purging of at least 10 well volumes) of the wells should occur no less than 72 hours following their completed construction.

Soil cuttings and purged groundwater generated during groundwater monitoring well installation/sampling should be containerized in 55-gallon drums and stored on-site while arrangements are made for appropriate disposal.

Additional Remedial Measures / Soil Vapor Control

We recommend that post-remediation groundwater data be reviewed to evaluate the effectiveness of the described contaminant removal and any groundwater treatment to enhance biodegradation. If the post-remediation data indicate the likelihood that residual contaminant concentrations in groundwater beneath the building exceed the target clean-up values, measures to prevent or minimize soil vapor intrusion into the proposed hotel building may be warranted. Such measures could include the installation of an under-slab gas vapor membrane (such as Liquid Boot®) and/or sub-slab vapor venting. We could develop specific recommendations for soil vapor control if necessary.

---

[5] Raney Geotechnical, Inc.; "Geotechnical Investigation, The Inn at Town Center, 1400 First Street, Napa, California'; File No. 2952-001; February 2, 2007.

As indicated earlier in this report, the established clean-up values may not be entirely protective of construction workers. However it is noted that the analysis indicates that nearly all of this the construction worker hazard is associated with the highly uncertain assessment of the dermal contact with groundwater pathway. Our understanding of the proposed construction at the site indicates that only very limited portions of the site construction have the potential to involve dermal contact with groundwater; significant dermal contact with groundwater during construction is expected to be negligible. As such, we recommend that the risk to construction workers be managed by the development and implementation of construction safety measures to prevent or minimize dermal contact with groundwater. Our firm could develop such construction safety measures upon request. Additionally, we suggest that contingency measures be developed for the handling and disposal of any contaminated excess soil or removed (dewatered) groundwater generated during site development activities.

Reporting

Following the remedial activities, a summary report will be prepared including: a description of the remedial work completed; as-build drawings showing the limits of excavated area, the cut-off wall, and sampling locations; the results of the clearance soil and groundwater sampling/analytical testing; the results of stockpiled soils sampling/analytical testing; disposal manifests, and groundwater monitoring well installation information and data.

CLOSING

As required, a copy of this *Remedial Action Workplan* will be submitted to the San Francisco Bay Regional Water Quality Control Board and the Napa County Environmental Health Department. We suggest that comment is received from the lead oversight agency prior to initiating the remedial activities.

oOo

If you have any questions or require additional information, please contact the undersigned at (916) 371-0434.

Sincerely,

RANEY GEOTECHNICAL, INC.

Joe Brusca
Environmental Coordinator
Certified Engineering Geologist No. 1948

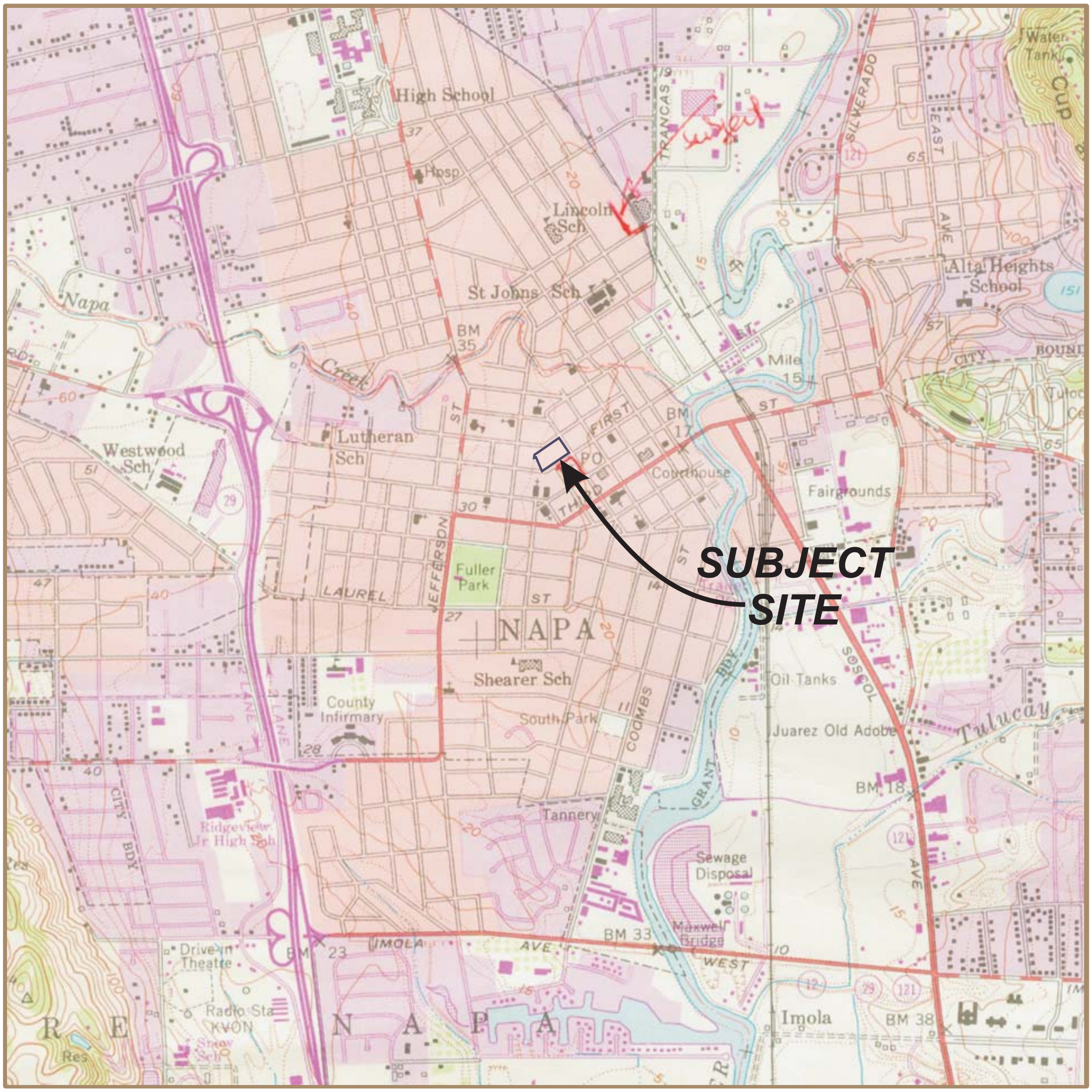
Attachments: Plate 1, Vicinity Map
Plate 2, Plot Plan
Plate 3, Extent of Soil Contamination
Plate 4, Extent of Groundwater Contamination
Plate 5, Remediation Plan
Plate 6, Profile of Remedial Area

Table I, Summary of Soil Analytical Data
Table II, Summary of Groundwater Analytical Data

Appendix A: Health Risk Assessment
Appendix B: Environmental Health and Safety Plan

(2) addressee
(1) Napa County Department of Environmental Management; Attention: Joel Coffman
(1) SFBRWQCB; Attention: Ralph Lambert
(1) Environmental Resources Management; Attention: Mark Bowland

PROJECT NUMBER: 2952-001.02 PLATE NUMBER: 1



SCALE 1:24000

1 ½ 0 1 MILE

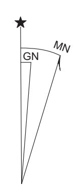
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 5 FEET

QUADRANGLE LOCATION

Reference: U.S.G.S. 7.5-minute Napa Quadrangle, California, 1980.



UTM GRID AND 1980 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

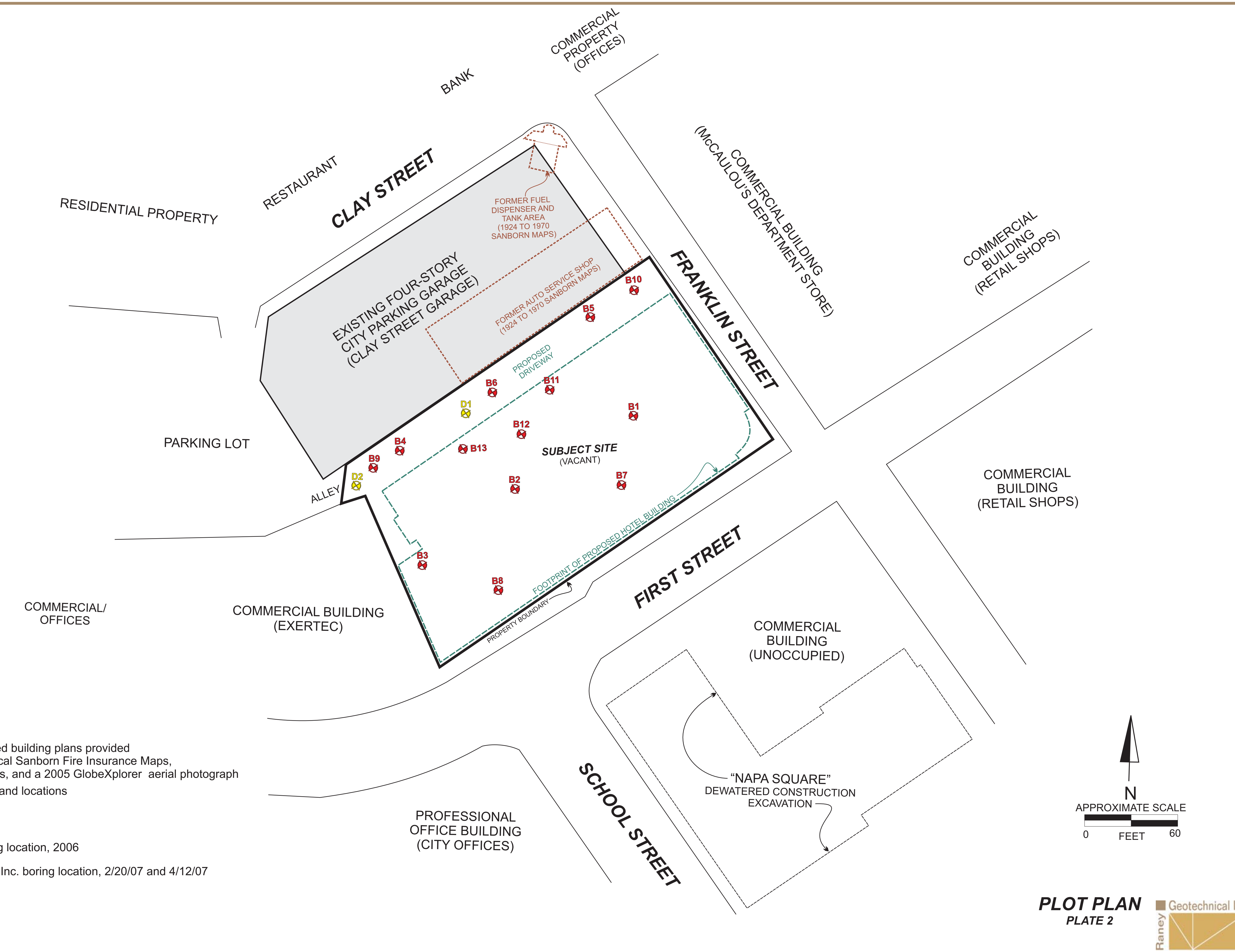
VICINITY MAP

PLATE 1

Raney Geotechnical Inc

PROJECT NUMBER: 2952-001.02

PLATE NUMBER: 2



NOTES:

1. Prepared from proposed building plans provided by Lodgeworks, historical Sanborn Fire Insurance Maps, Assessor's Parcel Maps, and a 2005 GlobeXplorer aerial photograph
2. All feature dimensions and locations are approximate only.

LEDGEND:

Wallace & Kuhl boring location, 2006

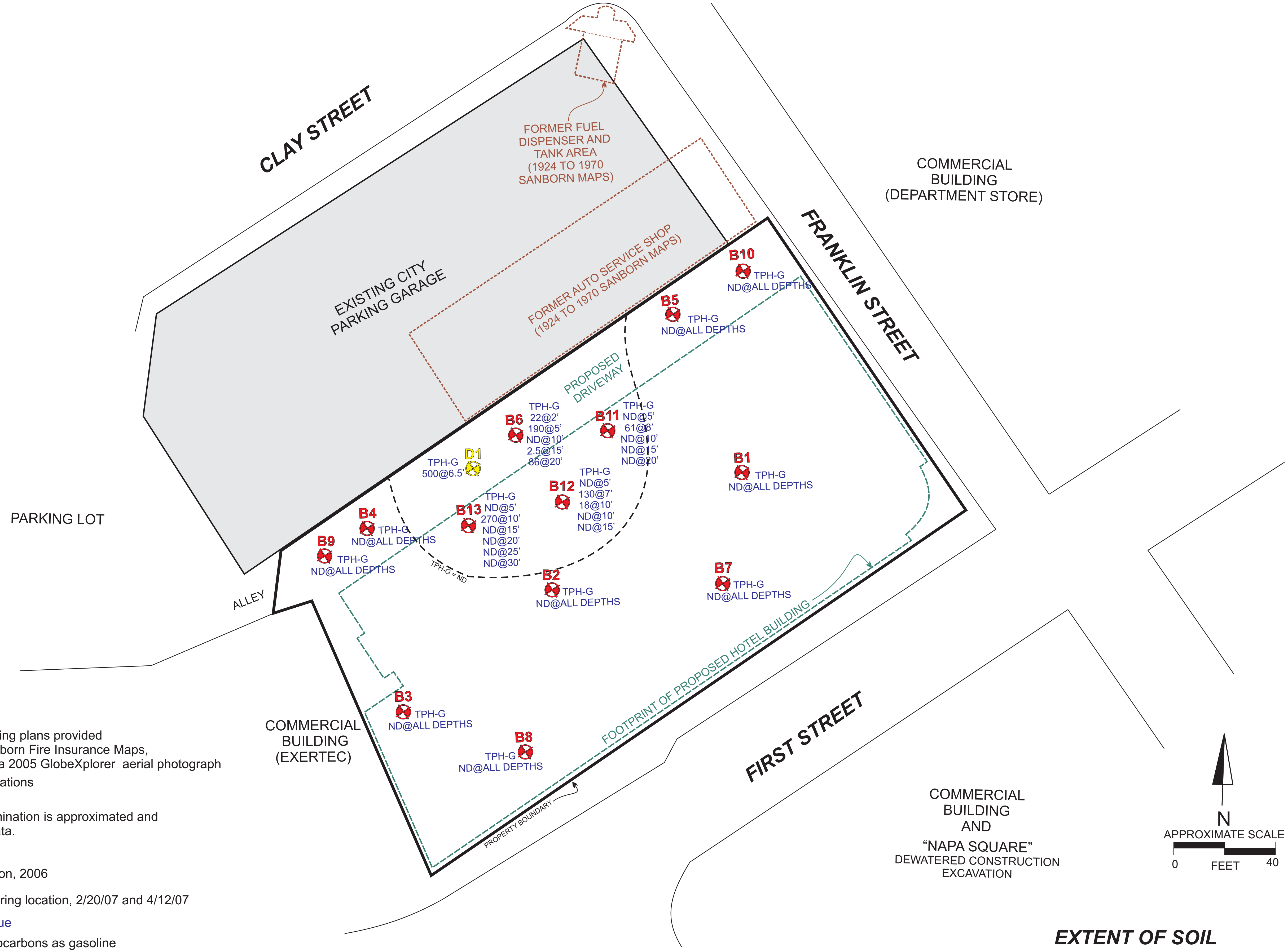
Raney Geotechnical, Inc. boring location, 2/20/07 and 4/12/07

PLOT PLAN

PLATE 2

Raney Geotechnical Inc

PROJECT NUMBER: 2952-001.02 PLATE NUMBER: 3



NOTES:

1. Prepared from proposed building plans provided by Lodgeworks, historical Sanborn Fire Insurance Maps, Assessor's Parcel Maps, and a 2005 GlobeXplorer aerial photograph
2. All feature dimensions and locations are approximate only.
3. Indicated extent of soil contamination is approximated and inferred based on available data.

LEDGEND:

Wallace & Kuhl boring location, 2006

Raney Geotechnical, Inc. boring location, 2/20/07 and 4/12/07

Soil analytical data shown in blue

TPH-G = Total Petroleum Hydrocarbons as gasoline

Soil TPH-G concentrations shown in milligrams per kilograms (mg/kg)

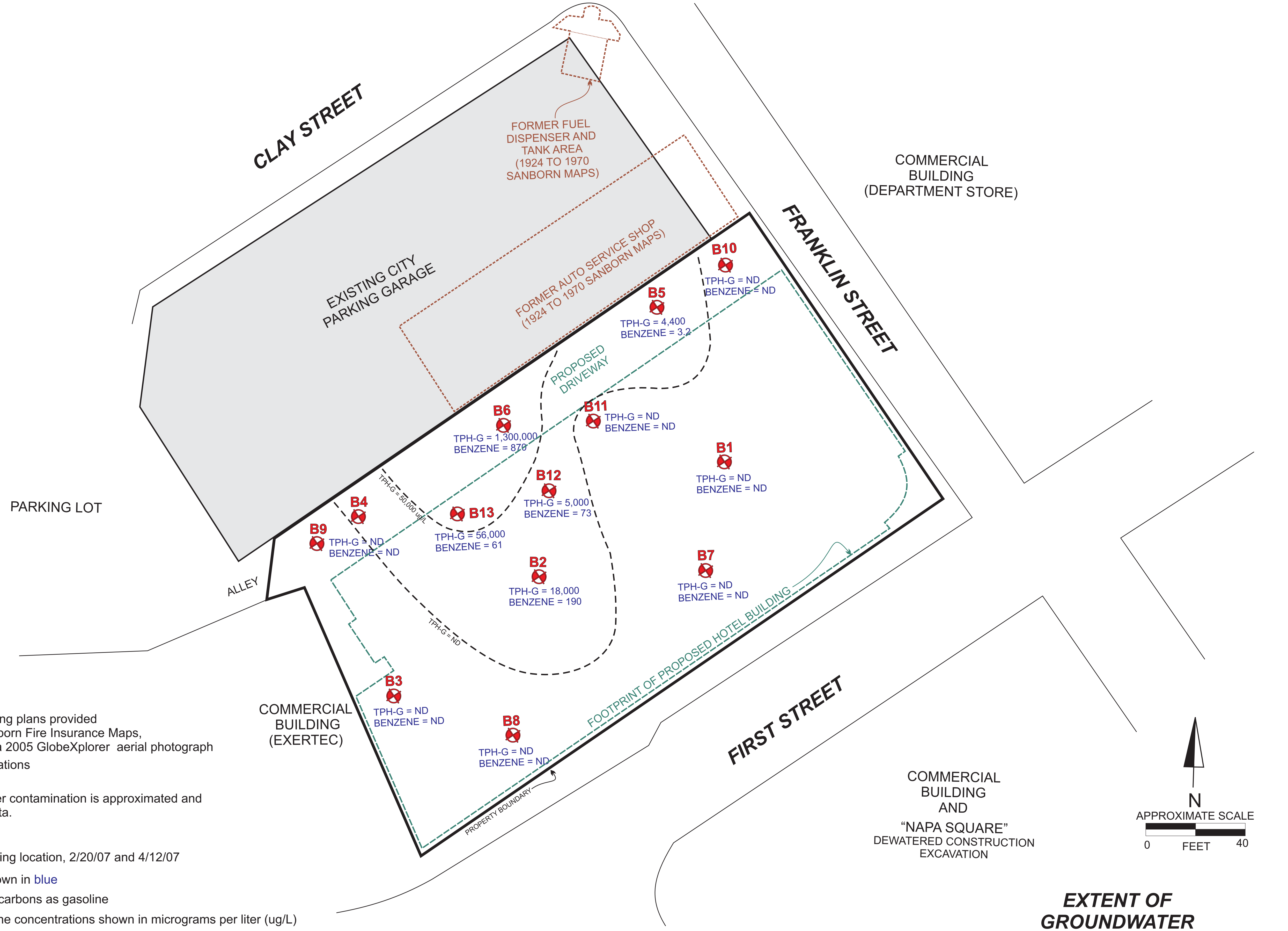
ND = Not detected at a concentration above the laboratory reporting limit

EXTENT OF SOIL CONTAMINATION

PLATE 3

Raney Geotechnical Inc

PROJECT NUMBER: 2952-001.02 PLATE NUMBER: 4



NOTES:

1. Prepared from proposed building plans provided by Lodgeworks, historical Sanborn Fire Insurance Maps, Assessor's Parcel Maps, and a 2005 GlobeXplorer aerial photograph
2. All feature dimensions and locations are approximate only.
3. Indicated extent of groundwater contamination is approximated and inferred based on available data.

LEDGEND:

Raney Geotechnical, Inc. boring location, 2/20/07 and 4/12/07

Groundwater analytical data shown in blue

TPH-G = Total Petroleum Hydrocarbons as gasoline

Groundwater TPH-G and benzene concentrations shown in micrograms per liter (ug/L)

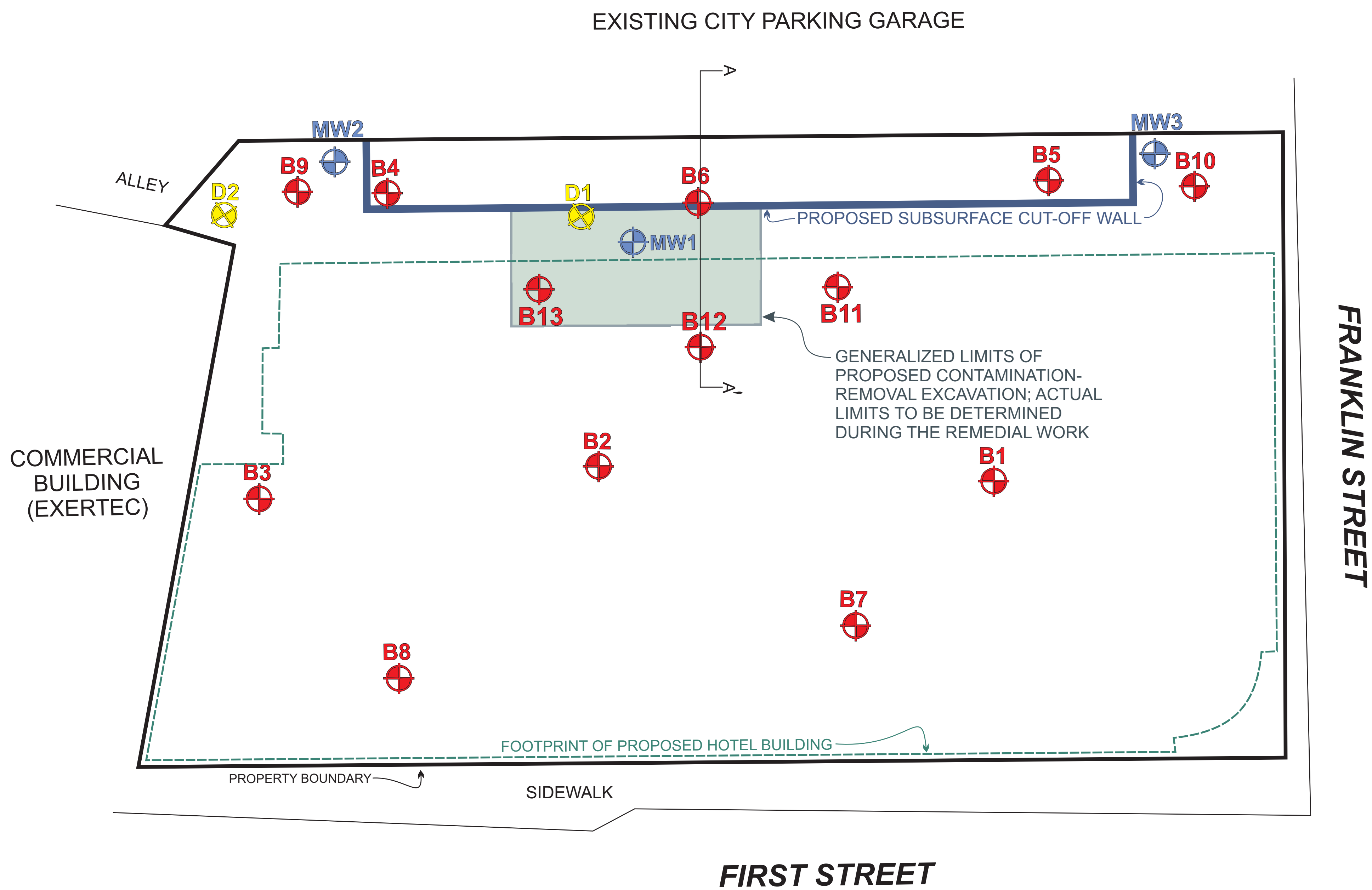
ND = Not detected at a concentration above the laboratory reporting limit

EXTENT OF GROUNDWATER CONTAMINATION

PLATE 4

Raney Geotechnical Inc

PROJECT NUMBER: 2952-001.02 PLATE NUMBER: 5



N

APPROXIMATE SCALE

0 FEET 30

NOTES:

1. Prepared from proposed building plans provided by Lodgeworks, historical Sanborn Fire Insurance Maps, Assessor's Parcel Maps, and a 2005 GlobeXplorer aerial photograph
2. All feature dimensions and locations are approximate only.

LEDGEND:

Wallace & Kuhl boring location, 2006

Raney Geotechnical, Inc. boring location, 2/20/07 and 4/12/07

Proposed groundwater monitoring wells

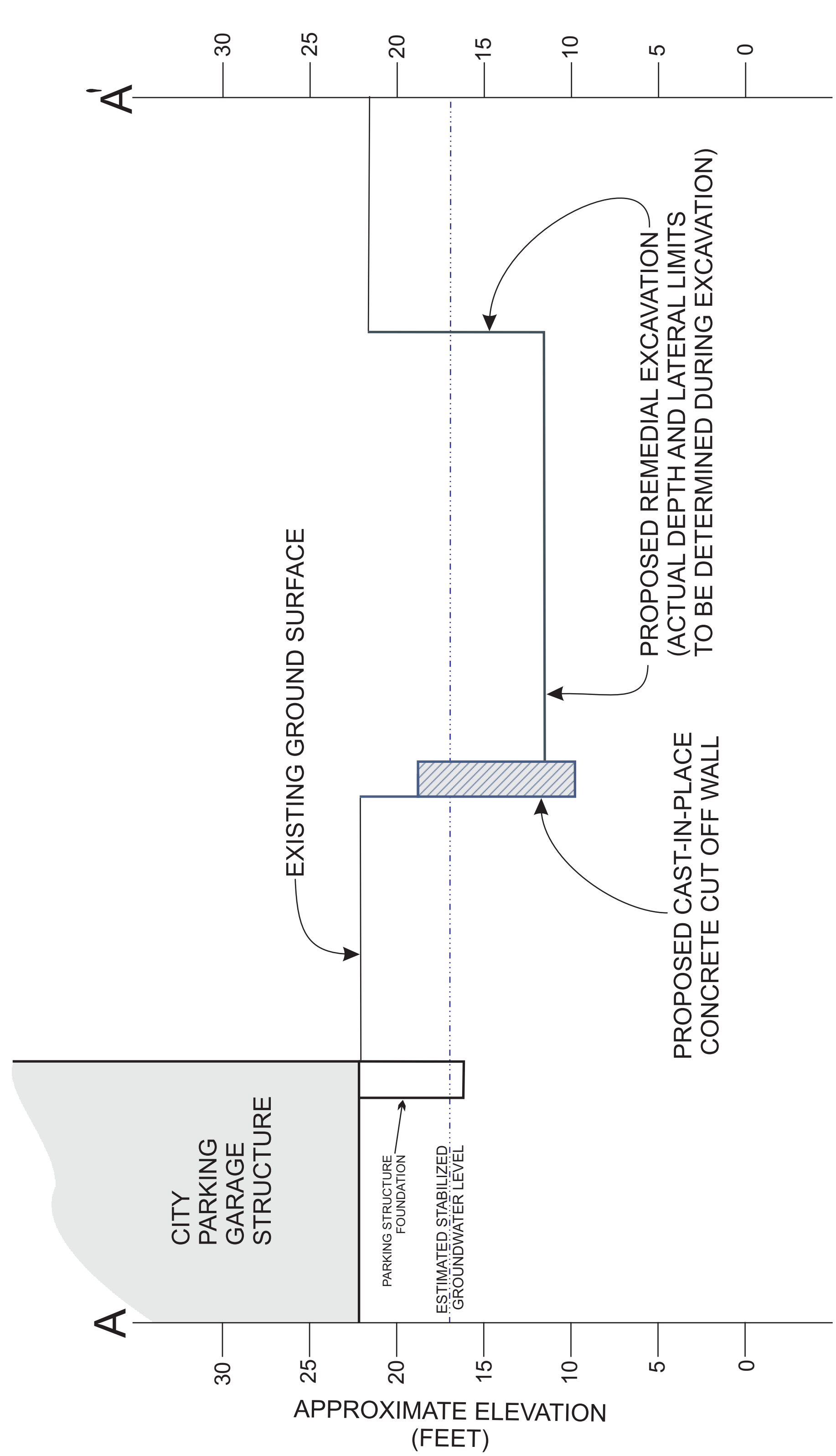
A A Profile of remedial area, see Plate 6

REMEDIATION PLAN

PLATE 5

Raney Geotechnical Inc

PROJECT NUMBER: 2952-001.02 PLATE NUMBER: 6



APPROXIMATE SCALE

0 FEET 10

PROFILE OF REMEDIAL AREA

PLATE 6

Raney Geotechnical Inc

TABLE I
SUMMARY OF SOIL ANALYTICAL DATA
NAPA LODGEWORKS PROPERTY
Franklin and First Streets
Raney Reference No. 2952-001.01

SAMPLE ID	DATE	LOCATION/ BORING (see Plate 2)	DEPTH (feet)	TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Xylenes
B1-2'	2/20/2007	B1	2.0	ND	ND	ND	ND	ND
B1-5'	2/20/2007	B1	5.0	ND	ND	ND	ND	ND
B1-10'	2/20/2007	B1	10.0	ND	ND	ND	ND	ND
B2-2'	2/20/2007	B2	2.0	ND	ND	ND	ND	ND
B2-10'	2/20/2007	B2	10.0	ND	ND	ND	ND	ND
B2-15'	2/20/2007	B2	15.0	ND	ND	ND	ND	ND
B3-2'	2/20/2007	B3	2.0	ND	ND	ND	ND	ND
B3-5'	2/20/2007	B3	5.0	ND	ND	ND	ND	ND
B3-15'	2/20/2007	B3	15.0	ND	ND	ND	ND	ND
B4-2'	2/20/2007	B4	2.0	ND	ND	ND	ND	ND
B4-5'	2/20/2007	B4	5.0	ND	ND	ND	ND	ND
B4-10'	2/20/2007	B4	10.0	ND	ND	ND	ND	ND
B4-20'	2/20/2007	B4	20.0	ND	ND	ND	ND	ND
B5-2'	2/20/2007	B5	2.0	ND	ND	ND	ND	ND
B5-5'	2/20/2007	B5	5.0	ND	ND	ND	ND	ND
B5-10'	2/20/2007	B5	10.0	ND	ND	ND	ND	ND
B6-2'	2/20/2007	B6	2.0	**22**	**0.076**	**0.030**	**0.349**	**0.820**
B6-5'	2/20/2007	B6	5.0	**190**	**0.013**	**0.061**	**0.200**	**0.649**
B6-10'	2/20/2007	B6	10.0	ND	ND	ND	**0.060**	**0.100**
B6-15'	2/20/2007	B6	15.0	**2.5**	ND	ND	**0.056**	**0.064**
B6-20'	2/20/2007	B6	20.0	**86**	**3.8**	**2.4**	**0.800**	**2.720**
B7-5'	4/12/2007	B7	5.0	ND	ND	ND	ND	ND
B7-10'	4/12/2007	B7	10.0	ND	ND	ND	ND	ND
B7-15'	4/12/2007	B7	15.0	ND	ND	ND	ND	ND
B8-5'	4/12/2007	B8	5.0	ND	ND	ND	ND	ND
B8-10'	4/12/2007	B8	10.0	ND	ND	ND	ND	ND
B8-15'	4/12/2007	B8	15.0	ND	ND	ND	ND	ND
B9-5'	4/12/2007	B9	5.0	ND	ND	ND	ND	ND
B9-10'	4/12/2007	B9	10.0	ND	ND	ND	ND	ND
B9-15'	4/12/2007	B9	15.0	ND	ND	ND	ND	ND
B9-20'	4/12/2007	B9	20.0	ND	ND	ND	ND	ND
B10-5'	4/12/2007	B10	5.0	ND	ND	ND	ND	ND
B10-10'	4/12/2007	B10	10.0	ND	ND	ND	ND	ND
B10-15'	4/12/2007	B10	15.0	ND	ND	ND	ND	ND
B10-20'	4/12/2007	B10	20.0	ND	ND	ND	ND	ND
B11-5'	4/12/2007	B11	5.0	ND	ND	ND	ND	ND
B11-8'	4/12/2007	B11	8.0	**61**	**0.019**	**0.250**	**0.460**	**0.490**
B11-10'	4/12/2007	B11	10.0	ND	ND	ND	ND	ND
B11-15'	4/12/2007	B11	15.0	ND	ND	ND	ND	ND
B11-20'	4/12/2007	B11	20.0	ND	ND	ND	ND	ND
B12-5'	4/12/2007	B12	5.0	ND	ND	ND	ND	ND
B12-7'	4/12/2007	B12	7.0	**130**	**0.490**	**0.400**	**0.800**	**0.690**
B12-10'	4/12/2007	B12	10.0	**18**	**0.044**	**0.073**	**0.097**	**0.071**
B12-15'	4/12/2007	B12	15.0	ND	ND	ND	ND	ND
B13-5'	4/12/2007	B13	5.0	ND	ND	ND	ND	ND
B13-10'	4/12/2007	B13	10.0	**270**	**1.000**	**0.720**	**3.900**	**13.400**
B13-15'	4/12/2007	B13	15.0	ND	ND	ND	ND	ND
B13-20'	4/12/2007	B13	20.0	ND	ND	ND	ND	ND
B13-25'	4/12/2007	B13	25.0	ND	ND	ND	ND	ND
B13-30'	4/12/2007	B13	30.0	ND	ND	ND	ND	ND

Notes.
1. All concentrations are expressed in milligrams per kilogram (mg/kg)
2. TPH = total petroleum hydrocarbons
3. ND = not detected at or above laboratory reporting limit

TABLE II

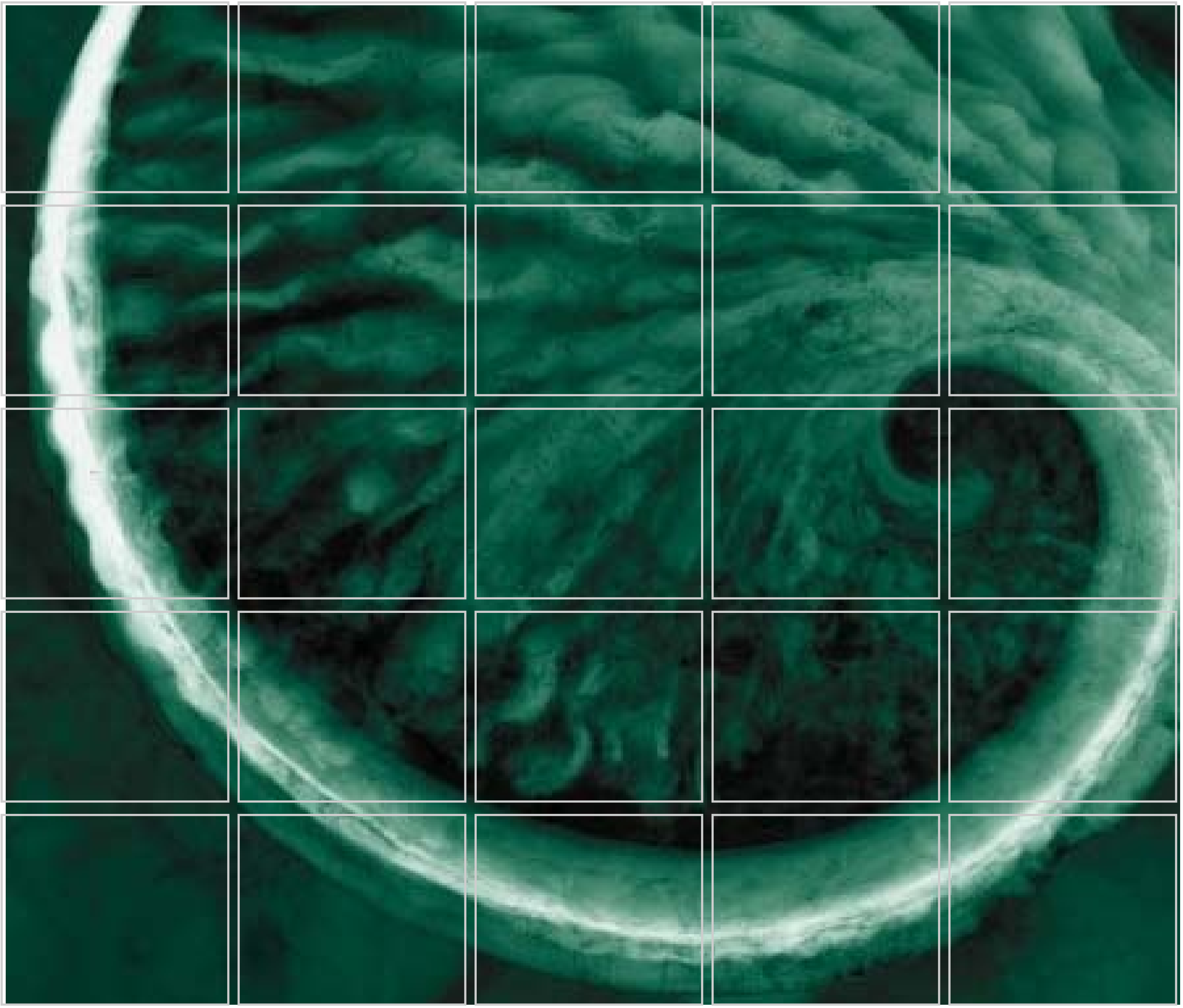
SUMMARY OF GROUNDWATER ANALYTICAL DATA
NAPA LODGEWORKS PROPERTY
Franklin and First Streets
Raney Reference No. 2952-001.01

SAMPLE ID	DATE	LOCATION/ BORING (see Plate 2)	TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Xylenes
B1-W	2/20/2007	B1	ND	ND	ND	ND	ND
B2-W	2/20/2007	B2	**18,000**	**190**	**100**	**170**	**135**
B3-W	2/20/2007	B3	ND	ND	**2.5**	ND	ND
B5-W	2/20/2007	B5	**4,400**	**3.2**	**1.9**	**5.8**	**8.8**
B6-W	2/20/2007	B5	**1,300,000**	**870**	**360**	**7,000**	**4,540**
B7-W	4/12/2007	B7	ND	ND	ND	ND	ND
B8-W	4/12/2007	B8	ND	ND	**1.2**	ND	ND
B9-W	4/12/2007	B9	ND	ND	ND	ND	ND
B10-W	4/12/2007	B10	ND	ND	**1.8**	ND	ND
B11-W	4/12/2007	B11	ND	ND	**1.3**	ND	ND
B12-W	4/12/2007	B12	**5,000**	**73**	**28**	**65**	**40**
B13-W	4/12/2007	B13	**56,000**	**61**	**250**	**1,500**	**2,880**

Notes.

1. All concentrations are expressed in micrograms per liter (ug/L)
2. TPH = total petroleum hydrocarbons
3. ND = not detected at or above laboratory reporting limit

APPENDIX A



Health Risk Assessment and Risk-Based Concentration Development Report

Franklin and First Streets
Napa, California

Prepared for:
Raney Geotechnical, Inc.

29 May 2007

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Health Risk Assessment and Risk Based Concentration Development Report
Franklin and First Streets
Napa, California

29 May 2007

0066309.0000.0000

Prepared for Raney Geotechnical, Inc.

Mark Bowland
Project Manager

Lee Shull, PhD.
Partner in Charge

Sandra Mulhearn
Environmental Scientist

Environmental Resources Management
2525 Natomas Park Drive, Suite 350
Sacramento, California 95833

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LIST OF ACRONYMS

bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylenes
COPC	Constituent of potential concern
DTSC	Department of Toxic Substances Control
EPA	Environmental Protection Agency
ERM	ERM-West, Inc.
HI	Hazard index
HQ	Hazard quotient
HRA	Health Risk Assessment
LNAPL	Light nonaqueous-phase liquid
MCL	Maximum contaminant level
MDEP	Massachusetts Department of Environmental Protection
OEHHA	Office of Environmental Health Hazard Association
OSWER	Office of Solid Waste and Emergency Response
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PRG	Preliminary remediation goal
RfD	Reference dose
RME	Reasonable maximum exposure
SVOC	Semivolatile organic compound
TPH	Total petroleum hydrocarbons
UCL	Upper confidence limit
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound

EXECUTIVE SUMMARY

On behalf of Raney Geotechnical, Inc (Raney), ERM-West, Inc., has prepared this Health Risk Assessment and Risk Based Concentration Development Report (HRA) for the Franklin and First Streets property (site) in Napa, California. This HRA uses data presented in the *Subsurface Investigation-Evaluation of Petroleum Hydrocarbon Contamination, Inn at Town Center Site* (Raney, 2007a) and *Additional Site Characterization-E valuation of Petroleum Hydrocarbon Contamination, Inn at Town Center Site* (Raney, 2007b) to assess the potential risks to human health.

The objective of this HRA is to quantitatively estimate the nature and extent of potential human health risks that might be posed to future receptors as result of assumed exposure to chemicals detected in soil and groundwater at the site. This HRA generally follows standard United States Environmental Protection Agency (USEPA) and California Department of Toxic Substances Control (DTSC) risk assessment procedures and methodologies.

Using information on intended future land use and existing information regarding pre-remediation baseline conditions, three receptor types were evaluated in this HRA: construction workers, outdoor maintenance workers, and commercial (hotel) workers. The results of this HRA indicate that there are no unacceptable risks for any of these receptors resulting from theoretical direct and indirect exposures to chemicals of potential concern (COPCs) in soil, but theoretical exposures to groundwater COPCs exceeded acceptable risk management metrics.

Based upon the relationships between COPC concentrations and risk estimates, risk-based concentrations considered protective of future receptors at the site were calculated for COPCs in soil and groundwater.

1.0 INTRODUCTION

On behalf of the Raney Geotechnical, Inc. (Raney), ERM-West, Inc. (ERM) has prepared this Health Risk Assessment and Risk Based Concentration Development Report (HRA) for the for the Franklin and First Streets property (site) in Napa, California. This HRA relies upon data presented in the *Subsurface Investigation-Evaluation of Petroleum Hydrocarbon Contamination, Inn at Town Center Site* (Raney, 2007a) and *Additional Site Characterization-E valuation of Petroleum Hydrocarbon Contamination, Inn at Town Center Site* (Raney, 2007b) to estimate potential risks to human health. The results identify exposure[1] potential for current and future human receptors at the property, and the magnitude and probability of potential threats to these receptors' health posed by substances currently present in soil and groundwater at the property including the assumption that these current concentrations will remain in these environmental media for 30 years into the future.

1.1 PURPOSE

The objective of this HRA is to quantitatively estimate the nature and extent of potential human health risks that might be posed to future receptors as a result of assumed exposure to chemicals detected in soil and groundwater at the site. Potential future receptors of concern are outdoor construction workers and indoor and outdoor commercial/maintenance workers at the property. The results of the evaluation will provide the basis for determining whether remedial action is needed to reduce potential human health risks at the site, and, if so, derivation of numerical cleanup standards that are specifically keyed to conditions and land use at the site and that, if met, will be protective of human health and the environment.

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[1] Exposure occurs when a person contacts a chemical found in the environment. Exposure is quantified as the concentration of a chemical contacted in a medium (*e.g.*, soil, air), averaged over the duration of the contact.

1.2 METHODOLOGY

The methodology for assessing risks at the subject property follows basic procedures outlined in the California Department of Toxic Substances Control (DTSC) *Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities* (DTSC, 1992) and *Preliminary Endangerment Assessment Guidance Manual* (DTSC, 1994), and the U.S. Environmental Protection Agency (EPA) *Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual* (EPA, 1989). In accordance with standard HRA practice, this HRA consists of four steps: data collection and evaluation; exposure assessment; toxicity assessment; and risk characterization. Each of these steps and how they are applied to the subject Site are discussed in later sections of this report.

1.2 REPORT ORGANIZATION

The remaining sections of this HRA report are organized as follows:

Section 2 *Site Background*	Describes the site background data.
Section 3 *Data Evaluation*	Describes and discusses the data relied upon in the HRA.
Section 4 *Exposure Assessment*	Identifies the potential receptor populations and exposure scenarios considered in this HRA, and outlines exposure assumptions and equations used to quantitatively characterize potential exposures.
Section 5 *Toxicity Assessment*	Describes the toxicity information used to assess the significance of the exposures defined in the previous step.
Section 6 *Risk Characterization*	Derives quantitative estimates of risk using exposure and toxicity information.
Section 7 *Risk Based Concentration Development*	Utilizing the relationship between concentration and quantitative estimates of risk using exposure and toxicity information, derives risk-based concentrations for each COPC that meet toxicity metrics.
Section 8 *Uncertainty Analysis*	Discusses the uncertainties associated with each step of the HRA.
Section 9 *Summary and Conclusions*	Summarizes the findings of the HRA.
Section 10 *References*	Lists the references used to develop the HRA.

2.0 BACKGROUND INFORMATION

The following site description and site investigation sections were excerpted directly (with permission) with minimal modifications from the Raney report entitled *Additional Site Characterization-E valuation of Petroleum Hydrocarbon Contamination, Inn at Town Center Site* (Raney, 2007b).

2.1 SITE DESCRIPTION

The approximate three-quarter-acre subject property is situated northwesterly of the intersection of First and Franklin Streets in Napa, California. The site is bordered to the north by a multi-story City parking garage, and to the west by a building that is occupied by a health and fitness facility (Exertec). Previous commercial buildings at the site were demolished late last year and the site is currently vacant. The surface of the site is covered with a layer of gravel that evidently is remnant of the demolition operations. We understand that construction of a five-story hotel structure on the property is planned.

In 2006, Wallace-Kuhl & Associates documented that a geotechnical boring on the northerly portion of the subject site encountered petroleum hydrocarbon contaminated soils.[2]

2.2 SITE INVESTIGATION

In early 2007, Raney collected soil and groundwater samples from six direct push borings (B1 through B6) at the site to evaluate the nature and extent of contamination; the results were presented in a report dated March 7, 2007.[3] These data indicated that significant petroleum

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[2] Wallace-Kuhl & Associates; "Report of Findings, Soil Sampling and Analysis, Inn at Town Center, Napa, California"; November 14, 2006.

[3] Raney Geotechnical, Inc.; "Subsurface Investigation – Evaluation of Petroleum Hydrocarbon Contamination, Inn at Town Center Site,

hydrocarbon contamination, likely including free product, exists beneath the northerly portion of the site. The lateral extent of significant shallow soil contamination was indicated to be limited; however, it appeared that groundwater contamination extends beneath a larger portion of the property. Preliminary discussion regarding remedial approaches was presented in the referenced March 7, 2007 report.

In April 2007, Raney directed the advancement of seven additional direct push (Geoprobe) borings (B7 through B13) at the locations shown on Plate 2 of the Raney (2007b) report. Borings B7 through B12 were advanced to a depth of 20 feet; Boring B13 was advanced to a depth of 30 feet (to evaluate the vertical extent of petroleum hydrocarbon contamination).

Continuous soil sampling was performed in each boring. Beneath an approximate one-foot thick surface layer of gravel materials the borings generally encountered fill soils consisting of a heterogeneous mixture of gravelly sands, silts and clays to depths ranging from two to three feet. Beneath the shallow surface fills, the borings typically encountered very clayey silts and silty clays. The deposits generally graded less clayey with depth; sandy silts and silty sands typically were encountered below depths of about 15 feet. Sparse to abundant gravel was encounter within the subsurface deposits locally. A prominent discontinuous gravelly deposit was encountered between depths of about six to 12 feet in the vicinity of Borings B11, B12, and B13; soils within this depth interval in these borings exhibited grey staining and a strong to moderate petroleum hydrocarbon odor. The soils encountered in the other borings did not exhibit visual or olfactory evidence of petroleum hydrocarbon contamination.

Groundwater was encountered in Borings B7, B8, B9, and B10 at depths ranging from about 15 to 20 feet; stabilized groundwater depths in these borings ranged from about nine to 18 feet, indicating variable confining conditions. Groundwater was encountered in Borings B11, B12, and B13 at depths on the order of ten to 12 feet; water stabilized in these borings at depths on the order of eight to 12 feet. It would appear that the mentioned permeable gravelly deposits encountered in these borings result in the occurrence of shallower groundwater beneath this portion of the site.

Northwesterly Corner of First and Franklin Streets, Napa, California"; March 7, 2007; Reference No. 2952-001.01.

Borings B7, B8, B9, and B10 did not contain petroleum hydrocarbons at concentrations above the laboratory reporting limit. Soil samples from Borings B11, B12 and B13 collected between depths of seven and ten feet contained TPH as gasoline at concentrations ranging from 18 to 270 milligrams per kilogram (mg/kg); these samples also contained low concentrations of BTEX constituents. Only the groundwater samples collected from the additional Borings B12 and B13 contained TPH as gasoline at concentrations above the laboratory reporting limit; these samples contained 5,000 micrograms per liter (ug/L) and 56,000 ug/L, respectively. The groundwater samples from Borings B12 and B13 also contained notable concentrations of BTEX constituents (including benzene at 73 ug/L and 61 ug/L, respectively). The groundwater samples from Borings B8, B10 and B11 contained very low concentrations of toluene.

The results from both investigations to date are presented for soil and groundwater in Tables 1 and 2, respectively.

3.0 DATA EVALUATION

This section presents a brief evaluation of the data incorporated into the HRA calculations including a description of the COPC selection process.

3.1 SUMMARY STATISTICS

Samples were collected from across the site, with specific emphasis given to the area of the property where encroachment of petroleum hydrocarbons was anticipated to be occurring (Raney, 2007a, b). Soil data were collected from 13 locations at multiple depths ranging from two feet below ground surface (bgs) to 20 feet bgs. Because the program was intended to identify possible concentrations of petroleum that may have encroached on site from off site, though not exhaustive, the data are likely sufficient to have bounded the order of magnitude concentrations of TPH-related components in soil and groundwater. Therefore, the data are considered sufficient to provide a rough order-of-magnitude estimate of hypothetical health risks and hazards associated with these detected concentrations. Uncertainties associated with the use of these data are presented in the Uncertainty Analysis section of this HRA (Section 8). Given the nature of the suspected petroleum source (encroachment of impacted groundwater from off-site resulting from historical releases), and the intended implementation of remedial action to prevent further encroachment, it is considered likely that on-site concentrations would decrease in the future. Pending

All TPH-related chemicals detected in groundwater and soil at the site (TPH-gasoline, TPH-diesel, TPH-motor oil, BTEX compounds, naphthalene, and trimethylbenzenes) are considered chemicals of potential concern (COPCs) and are treated accordingly in this HRA.

The exposure point concentrations (EPC) of each of the individual COPCs used in the risk assessment is calculated from measured concentrations in soil and groundwater samples collected in the onsite area of the property. Because of the uncertainty associated with determining the true average concentration at a site, EPA (2002a) recommends using the 95 percent upper confidence limit (95% UCL) of the arithmetic mean as the EPC to which an individual could be exposed over time. The 95% UCL is used to provide reasonable confidence that the true site average will not be underestimated.

Soil and groundwater UCLs were calculated using all the data from the two investigations (Raney 2007a, b). The summary statistics based upon all of the data are presented to provide the range of concentrations present at the site. The UCLs for only those samples containing detected concentrations of TPH were included in the UCL calculation so that the EPC would not be "diluted" by sample data that were non-detect for the COPCs. This approach was supported by the fact that most of the samples containing any of the COPCs were co-located in the northern part of the site where off-site encroachment of petroleum hydrocarbons was suspected, and represents the highest concentrations detected at the site. The USEPA ProUCL software version 3.0 (USEPA, 2004) was used to calculate UCL for each of the COPCs. This software tests the data set for consistency with several different possible distributions (reported in Tables 3 through 6). Based on how well the data fit a particular distribution, as well as data characteristics such as sample size and variance, the software selects a preferred methodology for calculating a 95% UCL of the arithmetic mean, and then presents the calculated UCLs for each of the alternative methods. In certain instances, ProUCL also recommends an alternative method for computing the UCL (e.g., when the initial recommended method results in a UCL exceeding the maximum detected concentration due to high data variability). When an alternate recommended methodology yields a UCL less than the maximum detected concentration, the alternate UCL is typically adopted in compliance with USEPA guidance (USEPA, 1989b, USEPA, 1992c). Where the maximum detected concentration is less than the recommended UCL and no alternative UCL is suggested by the software, the EPC is set equal to the maximum detected concentration.

Summary statistics generated for COPCs in soil are presented in Table 3 (all samples), Table 4 (detects only; B-2, B-6, B-11, B-12, B-13), and for groundwater are presented in Table 5 (all samples), and Table 6 (detects only; B2-W, B5-W, B6-W, B12-W, and B13-W).

3.2 TOTAL PETROLEUM HYDROCARBONS

Gasoline, diesel, motor oil and other petroleum products are complex mixtures of hydrocarbons. Once these products have been released into the environment, the composition of the mixture changes because the components have different physical and chemical properties (e.g., solubility in water, volatility, and soil adsorption coefficients). These properties dictate the behavior of each component in the environment. Consequently, a receptor will not be exposed to fresh product, but rather to a mixture of the various chemical components of petroleum hydrocarbons as they have 'weathered,' or changed in composition, as a result of many environmental influences.

The chemical composition has not accurately been quantitatively identified in most petroleum-based complex mixtures, such as gasoline and diesel. Routine qualitative and quantitative analyses of commercial products or impacted soil or groundwater for the purpose of establishing the chemical breakdown of hydrocarbon mixtures are currently impractical. This is primarily because the low potential usefulness of such data does not justify the high cost of routine chemical analysis.

For these reasons, the fractionation approach developed by the Massachusetts Department of Environmental Protection (MaDEP, 2002) is employed to assess risks in this HRA. This approach accounts for the differential weathering of petroleum hydrocarbons at the site and estimates risks accordingly. The approach consists of a) fractionation of petroleum products into chemical families or fractions, b) selection of surrogate chemicals that are considered representative of each fraction, c) normalization of surrogate chemicals to represent all chemicals within a fraction, and d) fate and transport modeling of the surrogate chemicals (i.e., fractions). The utility of the MaDEP fractionation approach is its applicability to all forms of petroleum products, whether fresh or weathered. The fraction-specific information for each of the TPH surrogates is presented in Table 7.

4.0 EXPOSURE ASSESSMENT

The exposure assessment step in an HRA combines information about the chemical concentrations in site media with assumptions about how an individual could contact the impacted media. The result is an estimation of a person's rate of intake, or dose, of a chemical.

In this section, the various ways in which people could be exposed to the COPCs in soil, or groundwater and the populations of people who could be exposed are identified and discussed. In addition, assumptions regarding a person's activities, such as the frequency with which they could come into contact with soil, are discussed. Finally, the daily dosages of COPCs at the points of potential human contact are estimated using these exposure assumptions and the chemical concentrations identified in this section.

4.1 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) describes the suspected sources of COPCs, fate and transport mechanisms that distribute these chemicals within the environment, the potentially exposed human populations, and the potentially complete exposure pathways. The CSM presents an exposure hypothesis, but is not intended to convey actual exposure and/or effects on receptors. For the purposes of this HRA, soil and groundwater are considered the "media of concern". Figure 3 presents the CSM with the primary exposure pathways for each of the categories of assumed future human receptors at the property identified.

4.1.1 Evaluation of Threat to Ground Water Quality

Based on the groundwater data provided from Raney (2007a, b), groundwater has already been impacted with TPH-gasoline, TPH-diesel, and TPH-motor oil and the only potentially identified sources are located off-site. Therefore, further evaluation of potential impacts posed by on-site soil on groundwater are not addressed in this HRA; it is assumed that any petroleum residues in onsite soil are the result of migration of impacted groundwater from off-site to on-site.

4.2 IDENTIFICATION OF POTENTIALLY EXPOSED POPULATIONS

In accordance with HRA guidance, the identification of people (i.e., receptors) that could potentially be exposed to chemicals at a site should consider both current and future land uses. Currently, the Site is unoccupied with no receptors present, so no current exposures are considered complete. The site is zoned commercial, is anticipated to remain so, and has been targeted for construction of a hotel. Therefore, the future land-use of the subject property assumes it would be developed for commercial purposes. Accordingly, an on-site outdoor worker (maintenance), and on-site indoor worker (hotel worker) are selected as the most likely post-development receptors. Construction workers are also considered potentially exposed populations to COPCs in soil and groundwater. Whereas other receptors (for example, visitors) may also be present at the property, the exposure frequency of these receptors is expected to be much less than commercial/industrial worker receptors. For example, commercial workers are assumed to be exposed eight hours per day, five days per week, 50 weeks per year for 25 years. Thus, if theoretical risks to commercial workers are within acceptable levels, it can be reasonably assumed that risks are also acceptable for other less-exposed receptors.

4.3 IDENTIFICATION OF POTENTIAL EXPOSURE PATHWAYS

The possible exposure pathways for indoor and outdoor commercial workers and construction workers at the property are examined to determine if COPCs in onsite soils and groundwater could pose a threat to the health of these receptors. The risks associated with exposure to these chemicals depends not only on the concentration of the chemicals in each media, but also on the frequency and duration of receptor exposures to these media.

An exposure pathway is a description of the ways in which a person could be exposed to chemicals and is defined by four elements: (1) a source and mechanism of chemical release to the environment (for example, release from a UST to soil); (2) an environmental transport medium (for example, air) for the released chemical; (3) a point of potential contact with the contaminated medium (the exposure point); and (4) an exposure route (for example, ingestion, inhalation) at the contact point. In order for an exposure pathway to be considered complete, all four elements must be present.

Potential health impacts from chemicals in a medium can occur via one or more exposure pathways. Not all theoretically possible exposure pathways and routes of exposure relevant to indoor and outdoor commercial workers and construction workers at the property are considered complete. A discussion of those exposure pathways considered most likely to occur is presented below.

Soil from two feet bgs to 20 feet bgs is known to contain detected concentrations of COPCs (Raney 2007a,b). It is conservatively assumed that during the course of foundation and utility installation, soils as deep as 10 feet bgs could be brought to the surface or otherwise become exposed. Therefore, direct human exposure to zero-to-10 feet bgs soil for outdoor maintenance workers is evaluated. Also consistent with USEPA (2002c), indoor workers are assumed to be exposed to these same soils as a result of limited incidental ingestion. Furthermore, construction workers who may participate in site improvement projects in the future could come into contact with zero-to-10 feet bgs soil.

VOCs volatilizing from subsurface soil and groundwater could migrate into indoor and outdoor air. Therefore, vapor migration and subsequent inhalation of VOCs by each of the theoretical receptors is possible and is therefore evaluated.

Because groundwater at the site is not currently used as a potable water source, the groundwater ingestion exposure pathway is not assessed. Furthermore, there is no evidence that groundwater at the site would ever be developed as a potable water source in the future. However, because groundwater is relatively shallow at the site, it is possible that during site improvement and excavation, shallow groundwater could be present in the excavations. Therefore, dermal contact with impacted groundwater is also evaluated for construction workers.

Based on the discussion presented above, the primary exposure pathways considered potentially complete for future indoor and outdoor commercial workers and construction workers are:

- Inhalation of soil COPCs in indoor air of buildings expected to be constructed in the future (e.g., hotel) by the future indoor commercial (hotel) workers (via vapor migration from the subsurface);

- Inhalation of volatile COPCs that could migrate from groundwater through the vadose zone into indoor air by a future indoor commercial (hotel) worker;

- Inhalation of volatile COPCs in outdoor air by the outdoor commercial (maintenance) workers and construction workers (via vapor migration from the subsurface);

- Direct contact (ingestion, dermal) with subsurface soils by future maintenance and construction workers;

- Incidental ingestion of soil by future indoor (hotel) workers; and

- Dermal contact with groundwater by future construction workers.

These exposure pathways were quantitatively evaluated for each of the potential receptors at the property.

4.4 EXPOSURE PARAMETERS

The risks associated with exposure to chemicals at the property depend not only on their concentrations, but also on the extent to which receptors are exposed (e.g., frequency, duration). For example, the risks associated with exposure for one hour per day are less than those associated with exposure at the same concentration for two hours per day. Because risks depend upon both the concentration and the extent of the exposure, the assumptions regarding the extent of exposure are discussed in this section for each of the complete exposure pathways identified above. Table 8 presents each of the exposure parameters used in this HRA for each receptor and exposure pathway.

Many of the assumptions regarding the extent of exposure to COPCs are a combination of reasonable maximum exposure (RME) and average exposure factors developed by EPA's Superfund program. All exposure factors used in this HRA are default values published by either EPA (1991a; 1997a; 2001a; 2001b) or DTSC (1992, 1994).

4.5 EXPOSURE POINT CONCENTRATIONS

As was discussed in Section 3.1, exposure point concentrations (EPCs) are based on measured data at the property. The 95% UCL or the maximum detected concentration, whichever was lower, of each COPC at the property were used as EPCs in calculating theoretical exposures of receptors, and as inputs for each of the fate and transport models. Potential model inputs were calculated for the 0 to 10 feet bgs soil horizon, which represents the interval containing shallowest detected concentrations of constituents and maximum depth to which construction workers are assumed to be exposed. Concentrations existent at depths deeper than 10 feet are not expected to contribute significantly to vapor migration due to the presence of the water table. It is assumed that the groundwater-monitoring program captures the potential contributions of chemicals volatilizing from deeper soils. In addition to the soils data, the groundwater data are utilized to assess the indoor and outdoor air exposure pathways. The COPC concentrations relied upon are presented in Tables 4 and 6.

4.5.1 Estimation of Outdoor Air Concentrations

Fluxes of volatile COPCs from soil and dispersion into outdoor air were estimated using the simple volatilization factor model from USEPA (2002). Fluxes from groundwater and dispersion into outdoor air were estimated using the simple volatilization factor model from ASTM (1995). Default values for chemical properties were applied in the model. ASTM or EPA soil property default values were used where site specific data were not available. Results of the on-site outdoor air modeling are presented in Tables 9 and 10.

4.5.2 Estimation of Indoor Air Concentrations

The Johnson and Ettinger (1991) model (EPA, 2002b and 2003a, DTSC, 2005) was used to estimate indoor air concentrations from soil and groundwater. The indoor commercial worker scenario was modified using site-specific or model default values (EPA, 2003a, DTSC, 2005). The parameters used in the model for soil and groundwater are presented in Tables 11 and 12.

4.6 QUANTIFICATION OF EXPOSURE

For all COPCs, the following methodology is used to estimate theoretical daily exposure levels or dosages. In this section, the EPCs of COPCs in groundwater and soil vapor are combined with the exposure parameters identified in Section 2.4 to estimate a receptor's average daily dose (ADD) and lifetime ADD (LADD) of each COPC. Dose rates for COPCs are expressed on a per unit body weight basis and are averaged over the exposure period for non-carcinogenic effects and over a lifetime for carcinogenic effects. Equations used for calculating ADD and LADD are from EPA (1992). Doses for the complete exposure pathways at the property (Section 4.3) are calculated separately. Later, in the risk characterization step of the risk assessment (Section 7), the ADD and LADD are combined with COPC specific toxicity parameters (Section 4.4) to estimate whether the calculated intake levels pose a threat to current and future receptors at the property.

The equations for calculating the ADD and LADD for each exposure pathway are presented below.

$$\text{Soil Ingestion Dose (mg/kg-day)} = \frac{CS \times IngR \times CF \times EF \times ED}{BW \times AT}$$

where:

CS	=	Constituent Concentration in Soil (mg/kg)
IngR	=	Ingestion Rate (mg soil/day)
CF	=	Conversion Factor (10^{-6} kg/mg)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period which exposure is averaged - days).

Daily dosages from dermal contact with soil were calculated using the following equation:

$$\text{Dermal Dose (mg/kg-day)} = \frac{CS \times CF \times SA \times AF \times EvF \times ABS \times EF \times ED}{BW \times AT}$$

where:

CS	=	Constituent Concentration in Soil (mg/kg)

CF	=	Conversion Factor (10^{-6} kg/mg)
SA	=	Skin Surface Area Exposed (cm^2)
AF	=	Adherence Factor of Soil (mg/cm^2-event)
EvF	=	Event Frequency (events/day)
ABS	=	Skin Absorption Factor (unitless)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period which exposure is averaged - days).

Inhalation exposure concentrations are calculated as follows:

$$\text{Inhalation Concentration (mg/m}^3\text{)} = \frac{Ca \times EF \times ED}{AT}$$

where:

Ca	=	Concentration in Air (mg/m^3)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
AT	=	Averaging Time (period which exposure is averaged - days).

Exposure doses from dermal contact with groundwater were calculated using the following equation:

$$\text{Dermal Dose (mg/kg-day)} = \frac{CW \times CF \times SA \times DA_{event} \times EvF \times EF \times ED}{BW \times AT}$$

where:

CW = Constituent Concentration in Water (mg/L)

CF = Conversion Factor (10^{-6} L/cm^3)

DA_{event}= Dermal Absorption from Water (cm/hr)

Dermal exposure to organic chemicals in water requires calculation of the dose that is absorbed through the skin. The dose absorbed (DA) per unit skin area per water contact event is based on receptor exposure properties (e.g., duration of exposure per event) and chemical specific properties (e.g., dermal permeability coefficient, lag time, and time to reach steady state). The equations for calculating dermal absorbed dose from water contact are:

$$DA_{event} = 2 \times K_p \times \sqrt{\frac{6 \times t_{event} \times \tau}{\pi}}, \text{ for } t_{event} < t^*$$

or

$$DA_{event} = K_p \times \left[\frac{t_{event}}{1+B} + 2\tau \times \left(\frac{1+3B}{1+B} \right) \right], \text{ for } t_{event} > t^*$$

where:

DA_{event}= absorption rate per unit skin area per water contact event (cm/event)

K_p = dermal permeability coefficient (cm/hr)

t_{event} = duration of exposure event (hour)

τ = chemical-specific lag time (hour/event)

t* = chemical-specific time to reach steady-state (hour)

B = relative contribution of permeability coefficients (unitless)

The following equation is used to calculate K_p where K_p values were not available from USEPA 2001:

$$\log K_p = -2.72 + 0.71 \log K_{ow} - 0.0061 \, MW$$

where:

K_p = dermal permeability coefficient (cm/hr)

K_{ow} = octanol-water partition coefficient (unitless)

MW = molecular weight(g/mol)

For most of the chemicals, the values of B, t*, and τ are presented in USEPA 2001. Where these values were not available, the following equations were used to calculate them:

To calculate B:

$$B = \frac{K_{ow}}{10^4}$$

To calculate τ, assuming $l_{sc} = 10^{-3}$ cm.

$$\tau = \frac{l_{sc}^2}{6D_{sc}}$$

where:

$$Log\frac{D_{sc}}{l_{sc}} = -2.72 - 0.0061MW$$

To calculate t*:

$$\text{If } B \leq 0.1\text{, then } t^* = 2.4\tau$$

or

$$\text{If } 0.1 \leq B \leq 1.17\text{, then } t^* = (8.4 \div 6 \log B) \times \tau$$

The permeability coefficients, lag times, and steady-state times for the dermal contact with water exposure pathways were directly obtained from or estimated based on USEPA guidance (2001) using the above formulas. Table 13 contains the chemical properties used to dermal absorbed doses from water contact, as well as the DA_{event} parameter calculated for each organic groundwater COPC.

The resulting ADDs and LADDs are presented in Tables 14 through 19 for outdoor commercial (maintenance) workers, indoor commercial (hotel) workers, and construction workers.

5.0 TOXICITY ASSESSMENT

This section describes the toxicity of the COPCs. Toxicity values for many chemicals are published in USEPA's on-line Integrated Risk Information System (IRIS; EPA, 2007). For petroleum hydrocarbons, MaDEP (2002) has developed fraction-specific surrogate toxicity criteria. In addition, toxicity values for carcinogens are published by the California Office of Environmental Health Hazard Assessment (OEHHA, 2007). Cancer slope factors (CSFs) are chemical specific, experimentally-derived potency values used to calculate the risk of cancer resulting from exposure to carcinogenic chemicals. A higher value implies a more potent carcinogen. Reference doses (RfDs) are experimentally derived "no effect" values used to quantify the extent of non-carcinogenic toxic effects from exposure to chemicals. Here, a lower value implies a more potent toxicant. These criteria are generally developed by EPA risk assessment work groups and listed in EPA risk assessment guidance documents and databases. The CSFs and RfDs available for all COPCs are presented in Table 19.

6.0 *RISK CHARACTERIZATION*

In the last step of an HRA, the estimated rate at which a person incidentally takes in a chemical (i.e., daily exposure level or dosage) is compared with information about the toxicity of that chemical to estimate theoretical upper-bound cancer risks or non-cancer health effects posed by exposure to the chemical. This step is known as risk characterization. In this section, the risk characterization methods are described and the HRA results presented.

6.1 *METHODS FOR ASSESSING NON-CANCER HEALTH EFFECTS*

Non-cancer health effects from COPCs are assessed by comparing the estimated average exposure rate (that is, ADDs estimated in the exposure assessment) with an established exposure level at which no adverse health effects are expected to occur for a long period of exposure (that is, the RfD listed in Section 5). ADDs and RfDs are compared by dividing the ADD by the RfD to obtain the ADD:RfD ratio. The ADD:RfD ratio is known as a hazard quotient.

$$\textit{Hazard Quotient} = \frac{ADD}{RfD}$$

where:

ADD = average daily dose in milligrams per kilogram per day (mg/kg-d)

RfD = reference dose (mg/kg-d)

If a person's average exposure is less than the RfD (i.e., if the hazard quotient is less than one), the chemical is considered unlikely to pose a significant non-carcinogenic health hazard to individuals under the given exposure conditions. Unlike carcinogenic risk estimates, a hazard quotient is not expressed as a probability. Therefore, while both cancer and non-cancer risk characterizations indicate a relative potential for adverse effects to occur from exposure to a chemical, a non-cancer adverse health effects estimate is not directly comparable with a cancer risk estimate.

If more than one pathway is evaluated, the hazard quotients for each pathway are summed to determine whether exposure to a combination of pathways poses a health concern. This sum of the hazard quotients is known as a hazard index.

$$Hazard\ Index = \sum Hazard\ Quotients$$

6.2 METHODS FOR ASSESSING CANCER RISKS

In the risk characterization, carcinogenic risk is estimated as the theoretical upper-bound incremental probability of an individual developing cancer over a lifetime as a result of a chemical exposure. Carcinogenic risks are evaluated by multiplying the estimated average exposure rate (that is, LADD calculated in the exposure assessment) by the chemical's CSF (in Section 4). The CSF converts estimated daily intakes averaged over a lifetime to incremental risk of an individual developing cancer. Because cancer risks are averaged over a person's lifetime, longer term exposure to a carcinogen will result in higher risks than shorter term exposure to the same carcinogen, if all other exposure assumptions are constant.

Theoretical upper-bound risk associated with low levels of exposure in humans is assumed to be directly related to an observed cancer incidence associated with high levels of exposure in animals. According to EPA (1989), this approach is appropriate for theoretical upper-bound incremental lifetime cancer risks of less than 1×10^{-2}. The following equations were used to calculate chemical-specific, pathway-specific, and total risks:

$$Risk = LADD \times CSF$$

where:

LADD= lifetime average daily dose (mg/kg-d)

CSF = cancer slope factor $(mg/kg\text{-}d)^{-1}$

and

$$Total\ Carcinogenic\ Risk = \sum Individual\ Chemical\ and\ Pathway\ Specific\ Risks$$

This assessment assumes that cancer risks from various exposure pathways are additive (i.e., cumulative risk). Thus, the result of the assessment is a high end estimate of the total carcinogenic risk. High end carcinogenic risk estimates are compared to EPA's acceptable risk range of one in one million (10^{-6}) to one in ten thousand (10^{-4}). A risk level of 10^{-6} represents a probability of one in one million that an individual could develop cancer from exposure to the potential carcinogen under a defined set of exposure assumptions. If the estimated risk falls below the risk value considered acceptable by EPA, the chemical is considered unlikely to pose a significant carcinogenic health risk to individuals under the given exposure conditions.

6.3 *QUANTITATIVE RISK ASSESSMENT RESULTS*

This section presents the conservative results of this HRA. The calculated theoretical upper-bound incremental lifetime cancer risk (ILCRs) were compared to the EPA acceptable risk range of 10^{-6} to 10^{-4}. According to USEPA, "…acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response." (EPA, 1990). The non-carcinogenic health effects were compared to a target hazard index of 1.0. The results of the risk assessment for the COPCs in soil and groundwater at the property, by receptor and pathway, are given in Tables 14 through 19, and are summarized in Table 21.

6.3.1 *Outdoor (Maintenance) Worker*

The theoretical upper-bound ILCR for outdoor commercial (maintenance) workers across pathways is 4×10^{-6}. About half (2×10^{-6}) of the risk is associated with direct contact with soils, and half is associated with indirect exposures to groundwater. This risk is within the most conservative end of EPA's acceptable risk range given above. Therefore, carcinogenic risks are not anticipated to be associated with current maintenance worker exposures to chemicals at the property.

The non-carcinogenic hazard indices for outdoor commercial (maintenance) workers across pathways is 6.3, with 6.0 of this estimated hazard index attributable to indirect exposures to groundwater. This is above the target hazard index of 1.0. Therefore, theoretical exposures to groundwater COPCs at the property as assessed in this HRA are potentially above target levels for this receptor.

6.3.2 *Commercial (Hotel) Indoor Worker Scenario*

The theoretical upper-bound ILCR for hypothetical future commercial (hotel) worker receptors across all pathways is 1×10^{-5} when modeling indoor air with soil and groundwater data. About 2×10^{-6} of the risk is associated with indirect exposures to soil, and 8×10^{-6} is associated with indirect exposures to groundwater.

The non-carcinogenic hazard index for hypothetical future indoor commercial/industrial worker receptors across pathways is 2.8 when modeling outdoor air with soil and groundwater data, with 1.9 associated with modeling indoor air vapor intrusion from groundwater. Therefore, theoretical exposures to groundwater COPCs at the property as assessed in this HRA are potentially above target levels for this receptor.

6.3.3 *Construction Worker Scenario*

The theoretical upper-bound ILCR for hypothetical future construction worker receptors across all pathways is 2×10^{-7} with modeling from soil and groundwater. This risk is below EPA's acceptable risk range given above. Therefore, carcinogenic risks should not be associated with hypothetical future construction worker exposures to chemicals at the property.

The non-carcinogenic hazard index for hypothetical future construction worker receptors across pathways is 50 with modeling from soil and groundwater. Virtually all of this value (44) is associated with the highly uncertain assessment of the dermal contact with groundwater pathway, and most of the remainder is associated with volatilization of groundwater COPCs into outdoor air. This level is above the target hazard index of 1.0. Therefore, exposures to COPCs at the property may result in adverse health effects to hypothetical future construction worker receptors assessed for the property.

7.0 *RISK-BASED CONCENTRATION (RBC) DEVELOPMENT*

The goal of the RBC determination is to establish cleanup levels at the Site that are protective of human health and the environment, that are acceptable to regulatory agencies (i.e., RWQCB, Cal/EPA) and the public, that are scientifically defensible, and that are practical and cost-effective. RBCs are based on the relationship between chemical concentration and estimated risk for each chemical detected at the site.

For individual carcinogens, RBCs are calculated using a target risk of 10^{-6} for individual COPCs. For non-carcinogens, target HIs of 0.5 and 1.0 were used as the acceptable levels. RBCs are only developed for those COPCs and media where cancer risks exceed 1×10^{-6} or non-cancer HIs exceed 1.0.

Because the exposure, risk, and the fate and transport models used are linear, the following equation is used to establish RBCs:

$$C_{target} = \frac{C_{current} \times RISK_{target}}{RISK_{current}}$$

where:

C_{target} = site-specific, chemical-specific RBCL (µg/L)

$C_{current}$ = present concentration of chemical (µg/L)

$RISK_{target}$ = target risk level (1.0 non-carcinogens; 10^{-6} carcinogens)

$RISK_{current}$ = current risk level

The only exception to the linear relationship is for TPH-gasoline exposure-risk estimates for hotel worker indoor air exposures. When the COPC concentration in groundwater exceeds the COPC's defined solubility limit, the model assesses the concentration at the solubility limit, which in this case, did not result in an estimated exposure for TPH-gasoline that exceeded 1.0. However, the HI for TPH gasoline was a significant contributor to the overall HI in excess of the target of 1.0 and because the model defaults to assessing risks associated with the solubility limit, it may not have accounted for the contributions to risk from the non-aqueous phase liquid (NAPL) concentrations of TPH gasoline present.

Therefore, the cleanup level for TPH-gasoline at the HI =1.0 was set equal to the solubility limit.

The RBCs calculated for each COPC and receptor scenario are presented in Table 22 for soil and Table 23 for groundwater.

8.0 UNCERTAINTY ANALYSIS

Risk estimates are values that have uncertainties associated with them. These uncertainties, which arise at every step of an HRA, are evaluated to provide an indication to risk managers of the relative degree of uncertainty associated with a risk estimate. In this section, a qualitative discussion of the uncertainties associated with the risk assessment for the site is presented.

An HRA is not intended to quantify actual risks to receptors as a result of theoretical chemical exposures. In fact, estimating actual risks is impossible because of the variability in the exposed or potentially exposed populations. Therefore, risk assessment is a means of estimating the theoretical upperbound probability that an adverse health effect (e.g., cancer, impaired reproduction) might occur in a receptor as a result of either actual or assumed chemical exposures. The multitude of conservative assumptions inherent in the risk assessment process guards against underestimation of risks.

Risk estimates are calculated by combining site data, assumptions about individual receptor's exposures to impacted media, and toxicity information. The uncertainties in this HRA can be grouped into four main categories that correspond to these steps:

- Uncertainties in environmental sampling and analysis
- Uncertainties in fate and transport modeling
- Uncertainties in assumptions concerning exposure scenarios
- Uncertainties in toxicity data and dose response extrapolations

8.1 ENVIRONMENTAL SAMPLING AND ANALYSIS

This HRA relies on the sampling results obtained from the soil and groundwater investigations conducted by Raney (2007a,b). Errors in sampling results can arise from the field sampling methods, laboratory analyses, and data analyses. Errors in laboratory analysis procedures are possible, although the impacts of these sorts of errors on risk estimates are likely to be low. The environmental sampling conducted at the site is one source of uncertainty in this HRA. However, the sampling locations were selected to identify the areas with the greatest likelihood of impacts; therefore, the sampling and analysis data should be sufficient to characterize the impacts and the associated potential risks. In fact, because the sampling locations are biased toward the more highly impacted areas of the site, the resulting risk estimates are more likely overestimates rather than underestimates of human health impacts.

8.2 FATE AND TRANSPORT MODELING

The assumptions and uncertainties inherent in each of the fate and transport models applied to the site are discussed in each of the individual model sections. To the extent practical, models have been calibrated to reflect actual site conditions. However, where site-specific data were unavailable, fate and transport models and their input parameters were selected such that modeled concentrations at a temporally or spatially remote receptor point would be overestimated. Thus, actual future concentrations of COPCs in each of the modeled media at the site are likely to be less than those predicted by the model.

Measured indoor and outdoor air concentrations are not available for comparison to the modeled air concentrations. However, from previous experience on other sites, the calculation of risks based on both measured soil and groundwater data results in more conservative risk estimates and RBCs than if modeling was conducted on measured soil vapor. This result occurs because the modeling requires a significant number of assumptions that convert groundwater and soil bulk concentrations into soil vapor equivalents. Unfortunately, the shallow nature of groundwater makes the collection of site soil vapor concentrations difficult.

Furthermore, there is significant uncertainty in the modeling of TPH related constituents into indoor air. USEPA and other authors have identified specific uncertainties and limitations of the J&E model for providing robust analytical solutions for the vapor intrusion to indoor air pathway for TPH-related compounds. More specifically, one of the greatest concerns is that the J&E model does not sufficiently account for attenuation and biodegradation of petroleum related compounds during migration through the vadose zone:

"EPA is not recommending that the J&E Model be used for sites contaminated with petroleum products…The J&E Model does not account for contaminant attenuation (biodegradation, hydrolysis, sorption, and oxidation/reduction). Attenuation is potentially a significant concern for these types of sites" (USEPA, 2003).

"An empirical field study (Fitzpatrick and Fitzgerald, 1997) indicated that the model may be overly conservative for nonchlorinated species (e.g., benzene, toluene, ethylbenzene and xylene) …The authors contribute the likely cause for this discrepancy is the significant biodegradation of the nonchlorinated compounds" (USEPA, 2003).

"…Second, aerobic biodegradation was deemed significant in determining the observed profiles at a large proportion of sites. This observation…can be used to argue that predictive models not accounting for biodegradation could overestimate the risks from upward vapor fluxes by 10-10,000 times at some sites" (Roggemans, Bruce, Johnson, and Johnson, 2001).

In this respect, because the J&E (and other vapor migration models used) model does not account for contaminant attenuation through biodegradation, hydrolysis, sorption, and oxidation/reduction, it is not an ideal model for estimating potential impacts to indoor from TPH-related components and will likely greatly overestimate the estimated impact potential.

8.3 HUMAN HEALTH RISK ASSESSMENT

Below is a discussion of the uncertainties inherent in each step of the risk assessment process.

8.3.1 Exposure Assessment

In this report, the exposure assessment is based on a number of assumptions with varying degrees of uncertainty (EPA, 1992). Uncertainties can arise from the types of exposures examined, the points of potential human exposure, the concentrations of COPCs at the points of human exposure, and the intake assumptions. These factors and the ways in which they contribute to the risk estimation are discussed below.

Types of Exposures Examined

The selection of exposure pathways is a process often based on professional judgment, which attempts to identify the most probable potentially harmful exposure scenarios. Because risks are not always calculated for all possible exposure pathways that may occur at a site, some underestimation of risk may occur. In the present HRA, potential risks were estimated for worker exposure scenarios at the site. Risks to potential receptors were estimated for a number of different exposure pathways (e.g., inhalation of volatiles). While other exposure routes could exist for a particular site use, these exposures are expected to be lower than the risks associated with the pathways considered.

Points of Human Exposure

Another source of uncertainty in the exposure assessment is the assumption made regarding the locations where individuals could be exposed to impacted media at the site. In this assessment, assumptions were made to indicate the locations where people could come into contact with impacted media. It is conservatively assumed that individuals will be exposed to a consistent COPC concentration in each media, based on the assumptions used in the assessment, regardless of where they are on the site. That is, fluctuations in chemical concentrations, either spatially or temporally, are not considered.

Intake Assumptions Used

The risks calculated depend largely on the assumptions used to calculate the rate of COPC intake. The uncertainties associated with the parameters used in this risk assessment are described below.

Individuals can come into contact with chemicals via a number of different exposure routes. For the reasonable maximum exposure scenarios, standard default rates were used for these exposures. These represent upper bound values and provide reasonable maximum activity assumptions. The use of these standard default and upper end values makes it likely that the risk is not underestimated, and may in fact be overestimated.

The amount of COPCs the body absorbs may be different from the amount of a COPC contacted. In this assessment, absorption of ingested and inhaled COPCs is conservatively assumed to be 100 percent. Actual chemical and site specific values are likely less than this default value.

Exposure Point Concentrations

The risks calculated also depend on the estimated exposure point concentrations. In estimating exposure point concentrations, due to the variability in the data, the maximum detected concentration of several COPCs were used. This is a very conservative assumption and is likely to have overestimated risks at the property.

8.3.2 *Toxicological Data and Dose Response Extrapolations*

The availability and quality of toxicological data is another source of uncertainty in the risk assessment. Uncertainties associated with animal and human studies may have influenced the toxicity criteria. Carcinogenic criteria are classified according to the amount of evidence available that suggests human carcinogenicity. EPA assigns each carcinogen a designation of A through E, dependent upon the strength of the scientific evidence for carcinogenicity. In the establishment of the non-carcinogenic criteria, conservative multipliers, known as uncertainty and modifying factors, are used.

Uncertainties in Animal and Human Studies

Extrapolation of toxicological data from animal tests is one of the largest sources of uncertainty in a risk assessment. There may be important, but unidentified, differences in uptake, metabolism, and distribution of chemicals in the body between the test species and humans. For the most part, these uncertainties are addressed through use of conservative assumptions in establishing values for RfDs and CSFs, which results in the likelihood that the risk is overstated.

Typically, animals are administered doses of a chemical in a standard diet or in air that are higher than would be experienced in an environmental setting. Humans may be exposed to much lower doses in a highly variable diet, which may affect the toxicity of the chemical. In these studies, animals, usually laboratory rodents, are exposed daily to the chemical agent for various periods of time up to their 2 year lifetimes. Humans have an average 70 year lifetime and may be exposed either intermittently or regularly for an exposure period ranging from months to a full lifetime. Because of these differences, it is not surprising that extrapolation error is a large source of uncertainty in a risk assessment.

Non-Carcinogenic Toxicity Criteria

In the establishment of the non-carcinogenic criteria, conservative multipliers, known as uncertainty factors, are used. Most of the chronic non-carcinogenic toxicity criteria that were located in the IRIS database have uncertainty factors of 1,000. This means that the dose corresponding to a toxicological endpoint (e.g., LOAEL) was divided by 1,000; thus increasing the toxicity by a factor of three. The purpose of the uncertainty factor is to account for the extrapolation of toxicity data from animals to humans and to insure the protection of sensitive individuals. However, in accomplishing these things, the uncertainty in the actual toxicity of the chemical in humans is greatly increased.

Additionally, some chemicals do not have published non-cancer toxicity criteria. As developing criteria can be a labor-intensive task, where data to develop such criteria were not readily available, non-cancer effects were not assessed. Although numerous conservative assumptions and procedures are integral to the risk assessment process and make it unlikely that non-cancer hazard is underestimated, the lack of such criteria adds another degree of uncertainty to the hazard estimates.

Carcinogenic Toxicity Criteria

Uncertainty due to extrapolation of toxicological data for potential carcinogens tested in animals-to-human data is more prominent for potentially carcinogenic chemicals than non-carcinogenic ones. EPA uses the LMS model to extrapolate the toxicological data. The LMS assumes that there is no threshold for carcinogenic substances; that is, exposure to even one molecule of a carcinogen is sufficient to cause cancer. This is a highly conservative assumption because the body has several mechanisms to protect against cancer.

The use of the LMS model to extrapolate is a well-recognized source of significant uncertainty in the development of carcinogenic toxicity criteria and, subsequently, theoretical carcinogenic risk estimates. At high levels of exposure, there may indeed be a risk of cancer regardless of whether the effect occurs via a threshold mechanism or not. An animal bioassay can't determine what happens at low levels of exposure, however, which are generally typical of human exposure levels.

At low levels of exposure, the probability of cancer cannot be measured but must be extrapolated from higher dosages. To do this, animals are typically exposed to carcinogens at levels that are orders of magnitude greater than those likely to be encountered by humans in the environment. It would be difficult, if not impossible, to perform animal experiments with a large enough number of animals to directly estimate the level of risk at the low exposure levels typically encountered by humans. Thus, to estimate the risk to humans exposed at low levels, dose response data derived from animals given high dosages are extrapolated downward using mathematical models such as the LMS, which assumes that there is no threshold of response. The dose response curve generated by the model is known as the maximum likelihood estimate (MLE). The slope of the 95 percent lower confidence interval (i.e., upper-bound limit) curve, which is a function of the variability in the input animal data, is taken as the CSF. CSFs are then used directly in cancer risk assessment.

The federal government, including EPA itself, has acknowledged the limitations of the high to low dose extrapolation models, particularly the LMS (EPA, 1991b). In fact, this aspect of cancer risk assessment has been criticized by many scientists (including regulatory scientists) in recent years. EPA is currently in the process of re evaluating the 1986 cancer risk assessment guidelines (EPA, 1996).

Even for genotoxic (i.e., non-threshold) substances, there are two major sources of bias embedded in the LMS: (1) its inherent conservatism at low doses and (2) the routine use of the linearized form in which the 95 percent upper confidence interval is used instead of the unbiased MLE. The inherent conservatism at low doses is due in part to the fact that the LMS ignores all of the numerous biological factors that argue against a linear dose- response relationship for genotoxic effects (e.g., DNA repair, immunosurveillance, toxicokinetic factors).

Several other factors inherent in the LMS result in overestimated carcinogenic potency: (1) any exaggerations in the extrapolation that can be produced by some high dose responses (if they occur) are generally neglected, (2) upper confidence limits on the actual response observed in the animal study are used rather than the actual response, resulting in upper-bound low dose extrapolations, which can greatly overestimate risk, and (3) non-genotoxic chemicals (i.e., threshold carcinogens) are modeled in the same manner as highly genotoxic chemicals.

The following excerpts are from the Regulatory Program of the United States Government, April 1990   March 1991, Executive Office of the President (EPA, 1991b):

None of (the) purported advantages of the LMS approach has a sound statistical basis. It is a fundamental axiom of statistics that unbiased estimates are generally preferred to biased ones. Using the upper confidence limit instead of the unbiased estimate exaggerates underlying specification errors instead of eliminating them. “Instability” is overcome, but at the cost of greater errors in specification. The problem with the LMS is that it generates biases that intensify with the degree to which the multistage model misspecifies the true dose response relationship.

The LMS cannot be justified as a method of scientific risk assessment. The "yardstick" defense implicitly asserts that scientific advancements in risk assessment methodology should take a back seat to the preservation of an outdated and misguided statistical procedure.

The habitual reliance upon either the multistage model or its LMS descendant cannot be supported by sound scientific principles.

Typically, animals are administered high doses, including the controversial maximum tolerated dose (MTD) of a chemical in a standard diet. Humans, on the other hand, may be exposed to much lower doses in a highly variable diet. In these studies, animals, usually laboratory rodents, are exposed daily to the chemical agent for various periods of time up to their 2 year lifetime. Humans have an average 70 year lifetime and may be exposed either intermittently or regularly for an exposure period ranging from months to a full lifetime. Because of these differences, extrapolation error is a large source of uncertainty in risk assessment.

Even if studies of chemical effect in humans are available, they generally are for workplace exposures far in excess of those expected in the environment. Uncertainties can be large because the activity patterns, exposure duration and frequency, individual susceptibility, and dose may not be the same in the study populations as in the individuals exposed to environmental concentrations. Because conservative methods are used in developing the RfDs and CSFs, the possibility of underestimating risks is low.

8.4 COMBINATIONS OF SOURCES OF UNCERTAINTY

Uncertainties from different sources are compounded in the risk assessment. For example, if a person's daily intake rate for a chemical is compared to an RfD to determine potential health risks, the uncertainties in the concentration measurements, exposure assumptions, and toxicities will all be expressed in the result. Therefore, by combining all upper bound numbers, the uncertainty is compounded, and the resulting risk estimate is generally above the 90th or 95th percentile, perhaps even greater than the 99th percentile.

9.0 *SUMMARY*

ERM has assessed the potential risks to human health posed by COPCs in soil and groundwater at the Franklin and First Street Site in Napa, California. In assessing the amount of COPCs construction worker, indoor (hotel) and outdoor (maintenance) workers could potentially intake during their daily activities, a series of conservative exposure assumptions were developed.

The concentrations of TPH and VOCs in soil and groundwater to which workers could potentially be exposed were based on available measured data by Raney. To ensure that human health is adequately protected, conservative concentrations, exposure parameters, and toxicity assumptions were used in estimating exposure potential and subsequent risks. Theoretical risks to future indoor (hotel) and outdoor (maintenance) commercial worker's and construction worker's health predicted by this assessment are unlikely to be underestimated and, in fact, likely overestimate the actual risk.

Carcinogenic risks and adverse health effects should not be associated with commercial worker and construction worker exposures to chemicals in soils at the property. Results indicate that potential all assessed commercial exposures to the levels of COPCs detected at the site fall within the most conservative end of or below both the EPA acceptable cancer risk range of 10^{-6} to 10^{-4} and below the non-cancer hazard index of 1.0 (EPA, 1990).

Estimated health effects relied on the available measured groundwater data may be associated with future potential commercial worker exposures to chemicals at the property. Results indicate that potential indoor and outdoor commercial and construction exposures to the levels of groundwater COPCs detected at the site fall above the EPA non-cancer hazard index of 1.0 (EPA, 1990). There is a great deal of uncertainty associated with the modeling of bulk soil TPH concentrations to indoor and outdoor air, and with estimating the dermal absorption of these compounds for the construction worker. As described above it has been stated in the scientific literature that the available air models do not account for the significant attenuation processes known to impact the migration of petroleum hydrocarbons through the vadose zone and into ambient air.

Since the risk assessment results showed that all assessed groundwater exposure pathways for commercial and construction workers exceeded target risk metrics, RBCs were developed for benzene, TPH-gasoline, TPH-motor oil, TPH-diesel, and trimethylbenzenes. RBCs were developed based on vapor intrusion modeling using measured groundwater concentrations.

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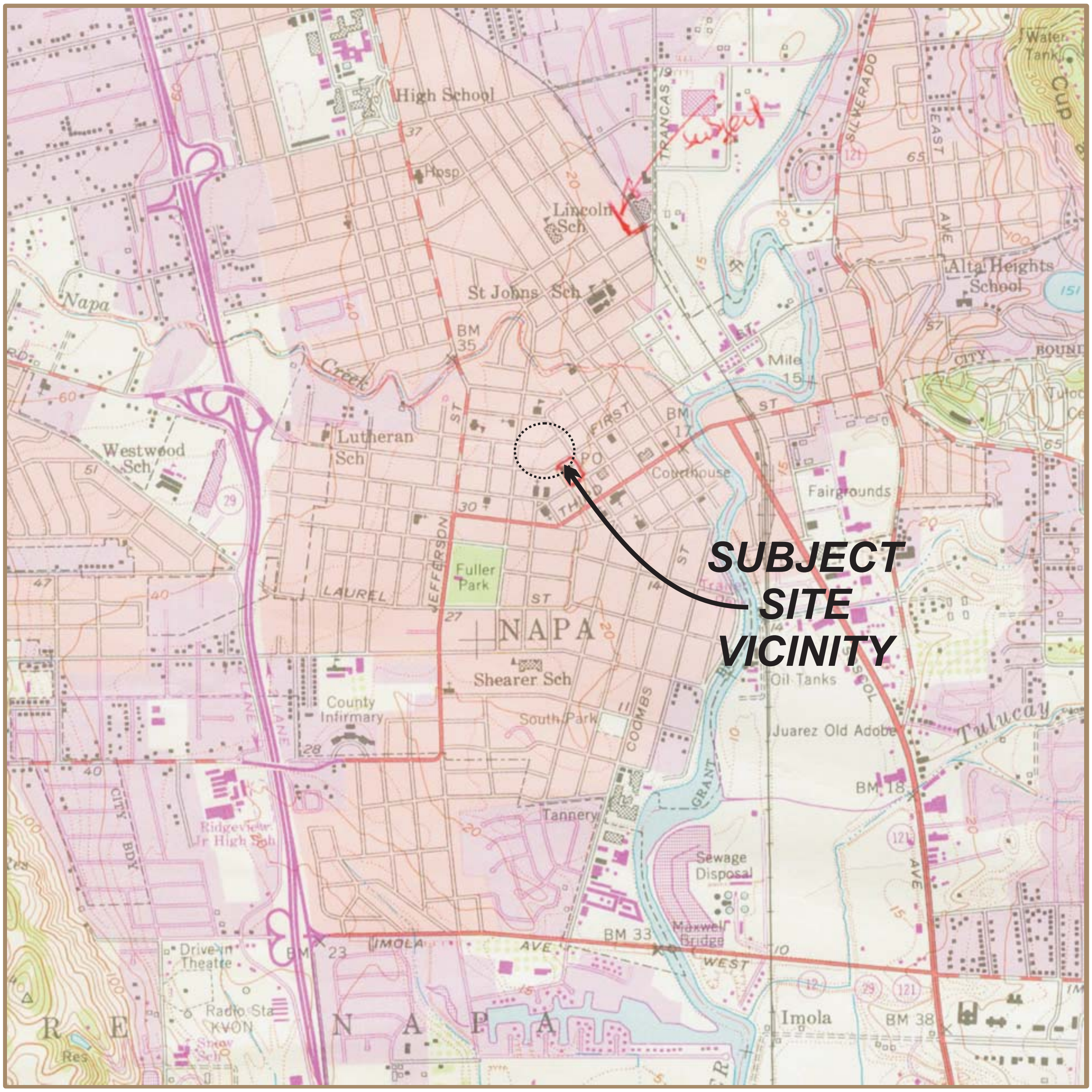
Figures



SCALE 1:24000

1 ½ 0 1 MILE

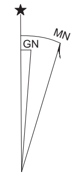
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 5 FEET

QUADRANGLE LOCATION

Reference: U.S.G.S. 7.5-minute Napa Quadrangle, California, 1980.

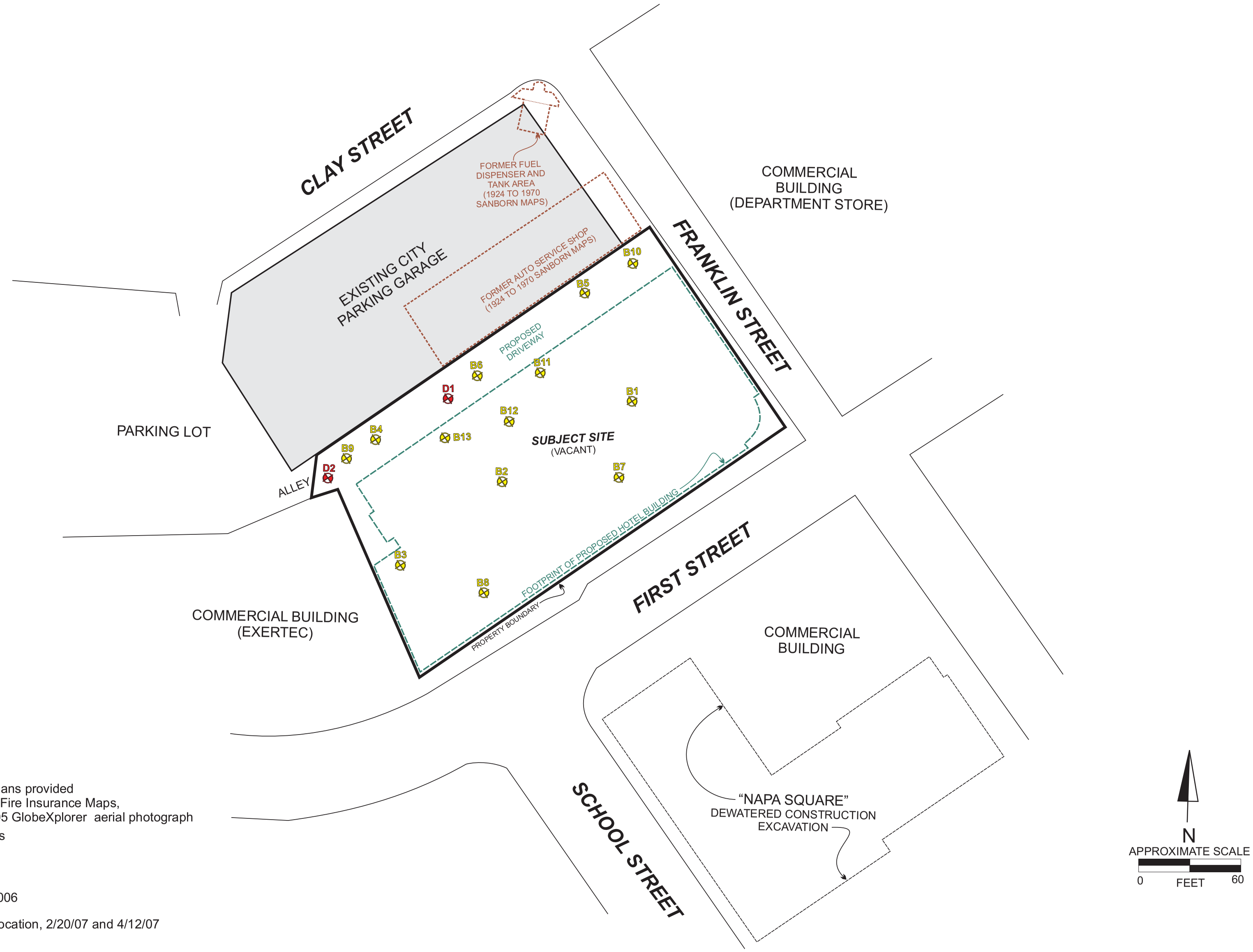


UTM GRID AND 1980 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

FIGURE 1

VICINITY MAP

Raney Geotechnical Inc



NOTES:

1. Prepared from proposed building plans provided by Lodgeworks, historical Sanborn Fire Insurance Maps, Assessor's Parcel Maps, and a 2005 GlobeXplorer aerial photograph
2. All feature dimensions and locations are approximate only.

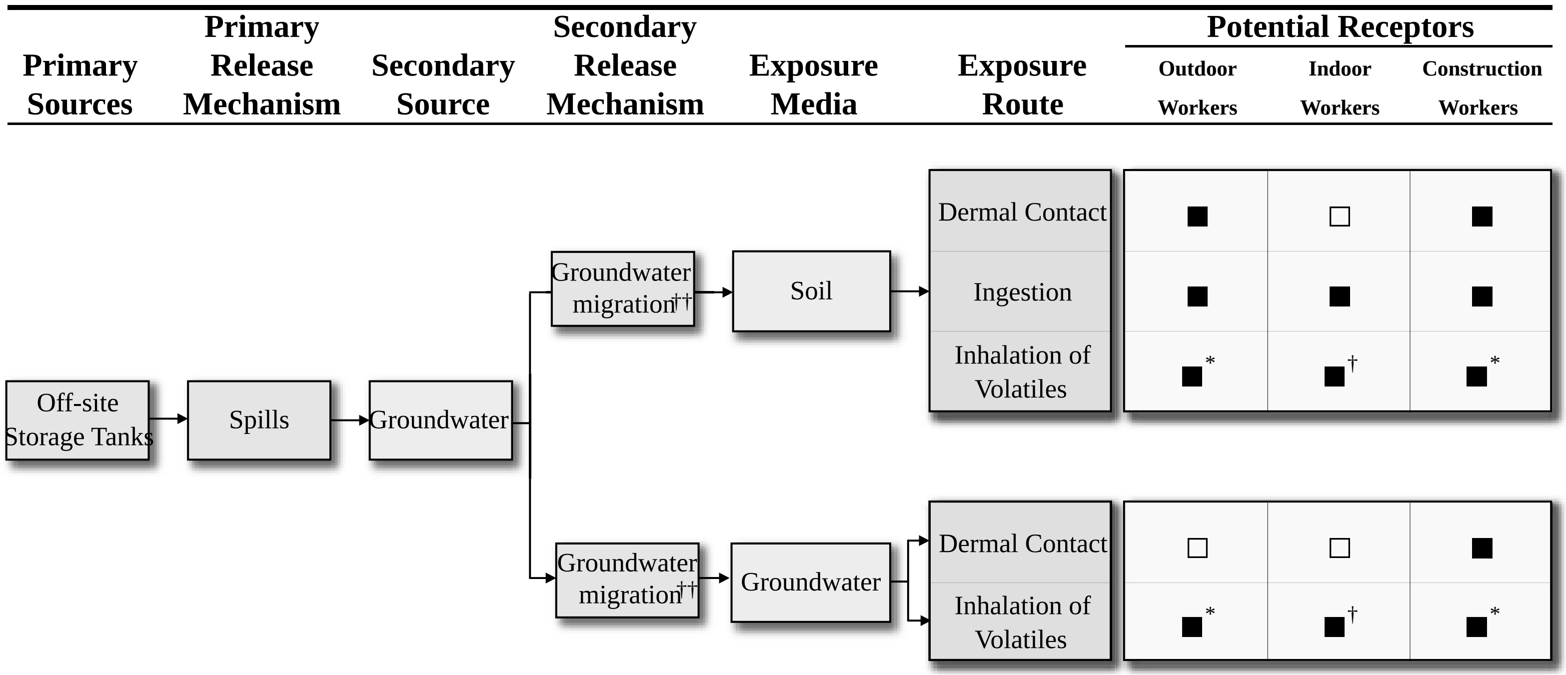
LEDGEND:

- Wallace & Kuhl boring location, 2006
- Raney Geotechnical, Inc. boring location, 2/20/07 and 4/12/07

FIGURE 2

PLOT PLAN

Raney Geotechnical Inc



■ - Potentially complete exposure pathway.

□ - Incomplete exposure pathway.

* Volatilization from subsurface into ambient outdoor air.

† Volatilization from subsurface into indoor air.

†† Migration of impacted groundwater from off site to onsite, with partitioning from groundwater to soil.

First and Franklin Streets
Napa, California

FIGURE 3

CONCEPTUAL
SITE MODEL

Prepared by: MB | Date 05/29/07 | JOB No. 0066309 FILE: CSM_FIGURE3.AI

Tables

Table 1

Summary of Analytical Results for Soil Samples
Napa Lodgeworks Property
Franklin and First Streets

SAMPLE ID	DATE	LOCATION/ BORING	DEPTH (feet)	TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Xylenes	TPH as Diesel	TPH as Motor Oil	n-Butylbenzene	sec-Butylbenzene	Isopropylbenzene	p-Isopropyltoluene	Methylene Chloride	Naphthalene	n-Propylbenzene	1,3,5-Trimethylbenzene	1,2,4-Trimethylbenzene
B1-2'	2/20/2007	B1	2.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B1-5'	2/20/2007	B1	5.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B1-10'	2/20/2007	B1	10.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B2-2'	2/20/2007	B2	2.0	ND	ND	ND	ND	ND	ND	ND	**0.015**	**0.0073**	**0.012**	ND	**0.024**	ND	**0.033**	ND	ND
B2-10'	2/20/2007	B2	10.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B2-15'	2/20/2007	B2	15.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B3-2'	2/20/2007	B3	2.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B3-5'	2/20/2007	B3	5.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B3-15'	2/20/2007	B3	15.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B4-2'	2/20/2007	B4	2.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B4-5'	2/20/2007	B4	5.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B4-10'	2/20/2007	B4	10.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B4-20'	2/20/2007	B4	20.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B5-2'	2/20/2007	B5	2.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B5-5'	2/20/2007	B5	5.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B5-10'	2/20/2007	B5	10.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B6-2'	2/20/2007	B6	2.0	**22**	**0.076**	**0.030**	**0.34**	**0.820**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B6-5'	2/20/2007	B6	5.0	**190**	**0.013**	**0.061**	**0.200**	**0.649**	**50**	**56**	**0.11**	**0.036**	**0.066**	**0.02**	ND	**0.18**	**0.2**	**0.23**	**1.3**
B6-10'	2/20/2007	B6	10.0	ND	ND	ND	**0.060**	**0.100**	ND	ND	**0.0098**	ND	**0.0097**	ND	ND	**0.015**	**0.029**	**0.02**	**0.12**
B6-15'	2/20/2007	B6	15.0	**2.5**	ND	ND	**0.056**	**0.064**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B6-20'	2/20/2007	B6	20.0	**86**	**3.8**	**2.4**	**0.800**	**2.720**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B7-5'	4/12/2007	B7	5.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B7-10'	4/12/2007	B7	10.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B7-15'	4/12/2007	B7	15.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B8-5'	4/12/2007	B8	5.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B8-10'	4/12/2007	B8	10.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B8-15'	4/12/2007	B8	15.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B9-5'	4/12/2007	B9	5.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B9-10'	4/12/2007	B9	10.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B9-15'	4/12/2007	B9	15.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B9-20'	4/12/2007	B9	20.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B10-5'	4/12/2007	B10	5.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B10-10'	4/12/2007	B10	10.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B10-15'	4/12/2007	B10	15.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B10-20'	4/12/2007	B10	20.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B11-5'	4/12/2007	B11	5.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B11-8'	4/12/2007	B11	8.0	**61**	**0.019**	**0.250**	**0.460**	**0.490**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B11-10'	4/12/2007	B11	10.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B11-15'	4/12/2007	B11	15.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B11-20'	4/12/2007	B11	20.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B12-5'	4/12/2007	B12	5.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B12-7'	4/12/2007	B12	7.0	**130**	**0.490**	**0.400**	**0.800**	**0.690**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B12-10'	4/12/2007	B12	10.0	**18**	**0.044**	**0.073**	**0.097**	**0.071**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B12-15'	4/12/2007	B12	15.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B13-5'	4/12/2007	B13	5.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B13-10'	4/12/2007	B13	10.0	**270**	**1.000**	**0.720**	**3.900**	**13.400**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B13-15'	4/12/2007	B13	15.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B13-20'	4/12/2007	B13	20.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B13-25'	4/12/2007	B13	25.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B13-30'	4/12/2007	B13	30.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes.
1. All concentrations are expressed in milligrams per kilogram (mg/kg)
2. TPH = total petroleum hydrocarbons
3. ND = not detected at or above laboratory reporting limit

Table 2
Summary of Analytical Results for Groundwater Samples
Napa Lodgeworks Property
Franklin and First Streets

SAMPLE ID	DATE	LOCATION/ BORING	TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	TPH as Diesel	TPH as Motor Oil	n-Butylbenzene	sec-Butylbenzene	Isopropylbenzene	p-Isopropylbenzene	Napthalene	n-Propylbenzene	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene
B1-W	2/20/2007	B1	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B2-W	2/20/2007	B2	**18,000**	**190**	**100**	**170**	**135**	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B3-W	2/20/2007	B3	ND	ND	**2.5**	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B5-W	2/20/2007	B5	**4,400**	**3.2**	**1.9**	**5.8**	**8.8**	ND	**1,900**	**7,400**	**49**	**21**	**56**	**5**	**7**	**100**	**100**	ND
B6-W	2/20/2007	B5	**1,300,000**	**870**	**360**	**7,000**	**4,540**	ND	**300,000**	**450,000**	**1,600**	**450**	**1,100**	**350**	**2,500**	**2,700**	**7,700**	**1,600**
B7-W	4/12/2007	B7	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B8-W	4/12/2007	B8	ND	ND	**1.2**	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B9-W	4/12/2007	B9	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B10-W	4/12/2007	B10	ND	ND	**1.8**	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B11-W	4/12/2007	B11	ND	ND	**1.3**	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B12-W	4/12/2007	B12	**5,000**	**73**	**28**	**65**	**40**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B13-W	4/12/2007	B13	**56,000**	**61**	**250**	**1,500**	**2,880**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes.

1. All concentrations are expressed in micrograms per liter (ug/L)
2. TPH = total petroleum hydrocarbons
3. ND = not detected at or above laboratory reporting limit

Table 3
On-Site Soil Data Evaluation - All Samples
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Samples	Detects	Frequency	Min Detect	Max Detect	Average	Stdev	Distribution	95%UCL	EPC
0-10 feet bgs										
TPH-Motor Oil (TPH-MO)	3	1	33%	56	56	22	29	-	-	56
C19-C36 Aliphatics										56
TPH-Diesel (TPH-D)	3	1	33%	50	50	20	26	-	-	50
C11-C22 Aromatics										30
C9-C18 Aliphatics										20
TPH-Gasoline (TPH-G)	32	6	19%	18	270	22	61	Nonparametric	129	129
C9-C10 Aromatics										129
Benzene	32	6	19%	0.013	1.0	0.1	0.2	Nonparametric	0.4	1.00
Toluene	32	6	19%	0.061	0.720	0.050	0.147	Nonparametric	0.309	0.3
Ethylbenzene	32	7	22%	0.060	3.900	0.185	0.699	Nonparametric	1.414	1.4
Total Xylenes	32	7	22%	0.071	13.400	0.513	2.362	Nonparametric	4.668	4.7
n-Butylbenzene	3	3	100%	0.0098	0.110	0.045	0.056	-	-	0.11
sec-Butylbenzene	3	2	67%	0.0073	0.036	0.015	0.018	-	-	0.04
Isopropylbenzene	3	3	100%	0.010	0.066	0.029	0.032	-	-	0.07
p-Isopropyltoluene	3	1	33%	0.020	0.020	0.008	0.010	-	-	0.02
Methylene Chloride	3	1	33%	0.024	0.024	0.010	0.012	-	-	0.02
Naphthalene	3	2	67%	0.015	0.180	0.066	0.099	-	-	0.18
n-Propylbenzene	3	3	100%	0.029	0.200	0.087	0.098	-	-	0.20
1,3,5-Trimethylbenzene	3	2	67%	0.020	0.230	0.084	0.127	-	-	0.23
1,2,4-Trimethylbenzene	3	2	67%	0.120	1.30	0.47	0.72	-	-	1.30
10-30 feet bgs										
TPH-Motor Oil (TPH-MO)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-Diesel (TPH-D)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-Gasoline (TPH-G)	18	2	11%	2.5	86.0	5.1	20.2	Nonparametric	52.5	52
C9-C10 Aromatics										52
Benzene	18	1	6%	4	4	0.21	0.9	Nonparametric	2.3	0.21
Toluene	18	1	6%	2.4	2.4	0.1	0.6	Nonparametric	1.46	0.14
Ethylbenzene	18	2	11%	0.06	0.80	0.05	0.19	Nonparametric	0.49	0.05
Total Xylenes	18	2	11%	0.06	2.72	0.16	0.64	Nonparametric	1.66	0.16
n-Butylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Isopropyltoluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

bgs = below ground surface.
All concentrations are expressed in milligrams per kilogram (mg/kg)

Table 4
On-Site Soil Data Evaluation - Detects Only
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Detects	Min Detect	Max Detect	Average	Stdev	Distribution	95%UCL	EPC
0-10 feet bgs								
TPH-Motor Oil (TPH-MO)	1	56	56	56	-	-	-	56
C19-C36 Aliphatics		56	56	56				56
TPH-Diesel (TPH-D)	1	50	50	50	-	-	-	50
C11-C22 Aromatics		30	30	30	-	-	-	30
C9-C18 Aliphatics		20	20	20	-	-	-	20
TPH-Gasoline (TPH-G)	6	18	270	115	101	Normal	198	198
C9-C10 Aromatics		18	270	115	101	-	-	198
Benzene	6	0.013	1.0	0.3	0.4	Gamma	1.3	1.00
Toluene	6	0.061	0.720	0.256	0.268	Normal	0.48	0.48
Ethylbenzene	7	0.060	3.900	0.837	1.374	Gamma	2.8	2.8
Total Xylenes	7	0.071	13.400	2.317	4.896	Lognormal	12	12.1
n-Butylbenzene	3	0.0098	0.110	0.045	0.056	-	-	0.11
sec-Butylbenzene	2	0.0073	0.036	0.022	0.020	-	-	0.04
Isopropylbenzene	3	0.010	0.066	0.029	0.032	-	-	0.07
p-Isopropyltoluene	1	0.020	0.020	0.020	-	-	-	0.02
Methylene Chloride	1	0.024	0.024	0.024	-	-	-	0.02
Naphthalene	2	0.015	0.180	0.098	0.117	-	-	0.18
n-Propylbenzene	3	0.029	0.200	0.087	0.098	-	-	0.20
1,3,5-Trimethylbenzene	2	0.020	0.230	0.125	0.148	-	-	0.23
1,2,4-Trimethylbenzene	2	0.120	1.30	0.710	0.834	-	-	1.30
10-30 feet bgs								
TPH-Motor Oil (TPH-MO)	NA	NA	NA	NA	NA	NA	NA	NA
TPH-Diesel (TPH-D)	NA	NA	NA	NA	NA	NA	NA	NA
TPH-Gasoline (TPH-G)	2	2.5	86.0	44.3	59.0	-	-	86
C9-C10 Aromatics	2	2.50	86.0	44.3	59.0	-	-	86
Benzene	1	3.8	3.8	3.80	-	-	-	3.8
Toluene	1	2.4	2.4	2.4	-	-	-	2.4
Ethylbenzene	2	0.06	0.80	0.43	0.53	-	-	0.43
Total Xylenes	2	0.06	2.72	1.39	1.88	-	-	1.39
n-Butylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
p-Isopropyltoluene	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA

bgs = below ground surface.
All concentrations are expressed in milligrams per kilogram (mg/kg)

Table 5
On-Site Groundwater Data Evaluation - All Wells
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Samples	Detects	Frequency	Min Detect	Max Detect	Average	Stdev	Distribution	Distribution 95% UCL	EPC
TPH-Gasoline (TPH-G)	12	5	42%	4,400	1,300,000	276,680	572,439	Gamma	1,187,905	1,187,905
C9-C10 Aromatics										
TPH-Motor Oil (TPH-MO)	2	2	100%	7,400	450,000	228,700	312,965	-	-	450,000
C19-C36 Aliphatics										
TPH-Diesel (TPH-D)	2	2	100%	1,900	300,000	150,950	210,789	-	-	300,000
C11-C22 Aromatics										
C9-C18 Aliphatics										
Benzene	12	5	42%	3.20	870	100	249	Nonparametric	815	815
Toluene	12	9	75%	1.90	360	148	153	Nonparametric	405	360
Ethylbenzene	12	5	42%	5.80	7,000	1,748	3,000	Nonparametric	6,532	6,532
Total Xylenes	12	5	42%	8.80	4,540	1,521	2,083	Nonparametric	4,886	4,540
n-Butylbenzene	2	2	100%	49.00	1,600	825	1,097	-	-	1,600
sec-Butylbenzene	2	2	100%	21.00	450	236	303	-	-	450
Isopropylbenzene	2	2	100%	56.00	1,100	578	738	-	-	1,100
p-Isopropyltoluene	2	2	100%	4.90	350	177	244	-	-	350
Naphthalene	2	2	100%	6.90	2,500	1,253	1,763	-	-	2,500
n-Propylbenzene	2	2	100%	100.00	2,700	1,400	1,838	-	-	2,700
1,3,5-Trimethylbenzene	2	1	50%	1,600.00	1,600	1,600	-	-	-	1,600
1,2,4-Trimethylbenzene	2	2	100%	100.00	7,700	3,900	5,374	-	-	7,700

All concentrations are expressed in micrograms per liter (ug/L)

Table 6
On-Site Groundwater Data Evaluation - Wells with Detected TPH Concentrations
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Samples	Detects	Frequency	Min Detect	Max Detect	Average	Stdev	Distribution	Distribution 95% UCL	EPC
TPH-Gasoline (TPH-G)	5	5	100%	4,400	1,300,000	276,680	572,439	Gamma	7,144,519	1,300,000
C9-C10 Aromatics										1,300,000
TPH-Motor Oil (TPH-MO)	2	2	100%	7,400	450,000	228,700	312,965	-	-	450,000
C19-C36 Aliphatics										450,000
TPH-Diesel (TPH-D)	2	2	100%	1,900	300,000	150,950	210,789	-	-	300,000
C11-C22 Aromatics										300,000
Benzene	5	5	100%	3.20	870	239	359	Gamma	1,572	870
Toluene	5	5	100%	1.90	360	148	153	Normal	294	294
Ethylbenzene	5	5	100%	5.80	7,000	1,748	3,000	Gamma	43,637	7,000
Total Xylenes	5	5	100%	8.80	4,540	1,521	2,083	Normal	3,507	3,507
n-Butylbenzene	2	2	100%	49	1,600	825	1,097	-	-	1,600
sec-Butylbenzene	2	2	100%	21	450	236	303	-	-	450
Isopropylbenzene	2	2	100%	56	1,100	578	738	-	-	1,100
p-Isopropyltoluene	2	2	100%	4.90	350	177	244	-	-	350
Naphthalene	2	2	100%	6.90	2,500	1,253	1,763	-	-	2,500
n-Propylbenzene	2	2	100%	100	2,700	1,400	1,838	-	-	2,700
1,3,5-Trimethylbenzene	2	2	100%	1,600	1,600	800	1,131	-	-	1,600
1,2,4-Trimethylbenzene	2	1	50%	100	7,700	3,900	5,374	-	-	7,700

All concentrations are expressed in micrograms per liter (ug/L)

Table 7
TPH Fractionation By Carbon Range
Napa Lodgeworks Property
Franklin and First Streets

Chemical	C11-C22 Aromatics	C19-C36 Aliphatics	C9-C18 Aliphatics	C9-10 Aromatics
Soils				
TPH-Diesel	60%	NA	40%	NA
TPH-Gasoline	NA	NA	NA	100%
Motor Oil[a]	NA	100%	NA	NA
Groundwater				
TPH-Diesel	100%	NA	NA	NA
TPH-Gasoline	NA	NA	NA	100%
Motor Oil[a]	NA	100%	NA	NA

All fractions based upon MaDEP (2002) except as otherwise noted.
[a]TPHCWG (1998).
Presence of these fractions (carbon ranges only) confirmed by analytical results.

Table 8
Vapor Diffusion Model - Soil to Ambient Air
Napa Lodgeworks Property
Franklin and First Streets

Parameter	Abbrev.	Units	Value	Reference
Dry bulk density	rb	(g/cm^3)	1.48	USEPA (2002, 2004) default
Water-filled soil porosity	qw	(unitless)	0.17	USEPA (2002, 2004) default
Total soil porosity	n	(unitless)	0.44	USEPA (2002, 2004) default
Soil particle density	rs	(g/cm^3)	2.65	USEPA (2002, 2004) default
Air-filled porosity	qa	(unitless)	0.270	USEPA (2002, 2004) default
Fraction of organic carbon	foc	(unitless)	0.006	USEPA (2002, 2004) default
Exposure Interval	T	seconds	9.46E+08	USEPA (2002, 2004) default

	Henry's Law Coefficient H (atm-m^3/mol)	Henry's Law Coefficient H' (unitless)	Organic Carbon Partitioning Koc (L/kg)	Diffusivity in Air Di (cm^2/s)	Diffusivity in Water Dw (cm^2/s)	Soil-Water Partitioning Coefficient Kd (cm^3/g)	Mol. Weight (g/mol)	Chemical Volatile?	Apparent Diffusivity D_A (cm^2/s)	Volatiliation Factor VF_w (m^2-s/g)	Q/C (g/m^2-s / kg/m^3)	Volatiliation Factor VF_w (m^3/kg)
Benzene	5.6 E-3	2.3 E-1	5.9 E+1	8.8 E-2	9.8 E-6	3.5 E-1	78.1	yes	1.7 E-3	4.4 E+1	68.18	3.0 E+3
Ethylbenzene	7.9 E-3	3.2 E-1	3.6 E+2	7.5 E-2	7.8 E-6	2.2 E+0	106	yes	4.6 E-4	8.6 E+1	68.18	5.9 E+3
Toluene	6.6 E-3	2.7 E-1	1.8 E+2	8.7 E-2	8.6 E-6	1.1 E+0	92	yes	8.4 E-4	6.4 E+1	68.18	4.3 E+3
Xylenes (o,m,p)	6.7 E-3	2.8 E-1	3.9 E+2	7.8 E-2 a	8.7 E-6 a	2.3 E+0	121	yes	3.8 E-4	9.4 E+1	68.18	6.4 E+3
Total Petroleum Hydrocarbons-Diesel (TPH-D)												
C11-C22 Aromatics	7.3 E-4	3.0 E-2	5.0 E+3	6.0 E-2	1.0 E-5	3.0 E+1	150	yes	2.7 E-6	1.1 E+3	68.18	7.7 E+4
C9-C18 Aliphatics	1.7 E+0	6.9 E+1	6.8 E+5	7.0 E-2	5.0 E-6	4.1 E+3	170	yes	5.2 E-5	2.5 E+2	68.18	1.7 E+4
Total Petroleum Hydrocarbons-Gasoline (TPH-G)												
C9-C10 Aromatics	8.0 E-3	3.3 E-1	1.8 E+3	7.0 E-2	1.0 E-5	1.1 E+1	120	yes	9.5 E-5	1.9 E+2	68.18	1.3 E+4
n-Butylbenzene	1.3 E-2	5.4 E-1	2.8 E+3	7.5 E-2	7.8 E-6	1.7 E+1	1.3 E+2	yes	1.0 E-4	1.8 E+2	68.18	1.2 E+4
sec-Butylbenzene	1.9 E-2	7.7 E-1	2.2 E+3	7.5 E-2	7.8 E-6	1.3 E+1	1.3 E+2	yes	1.9 E-4	1.3 E+2	68.18	9.0 E+3
Isopropylbenzene	1.1 E-2	4.3 E-1	2.2 E+2	7.5 E-2	7.1 E-6	1.3 E+0	1.2 E+2	yes	9.5 E-4	6.0 E+1	68.18	4.1 E+3
p-Isopropyltoluene	1.1 E-2	4.3 E-1	2.2 E+2	7.5 E-2	7.1 E-6	1.3 E+0	1.2 E+2	yes	9.5 E-4	6.0 E+1	68.18	4.1 E+3
Methylene Chloride	2.2 E-3	9.0 E-2	1.2 E+1	1.0 E-1	1.2 E-5	7.0 E-2	8.5 E+1	yes	2.0 E-3	4.1 E+1	68.18	2.8 E+3
Naphthalene	4.8 E-4	2.0 E-2	1.2 E+3	5.9 E-2	7.5 E-6	7.1 E+0	1.3 E+2	yes	7.2 E-6	6.9 E+2	68.18	4.7 E+4
n-Propylbenzene	1.1 E-2	4.3 E-1	2.8 E+3	7.5 E-2	7.8 E-6	1.7 E+1	1.3 E+2	yes	8.3 E-5	2.0 E+2	68.18	1.4 E+4
1,3,5-Trimethylbenzene	7.7 E-3	3.2 E-1	8.2 E+2	7.5 E-2	7.1 E-6	4.9 E+0	1.2 E+2	yes	2.1 E-4	1.3 E+2	68.18	8.7 E+3
1,2,4-Trimethylbenzene	5.6 E-3	2.3 E-1	3.7 E+3	7.5 E-2	7.1 E-6	2.2 E+1	1.2 E+2	yes	3.4 E-5	3.2 E+2	68.18	2.2 E+4

NA Not available.
NC Not calculated.
Unless otherwise noted, values are from USEPA *Soil Screening Guidance: Technical Background Document* (1996).

Table 9
Vapor Diffusion Model - Groundwater to Ambient Air [a]
Napa Lodgeworks Property
Franklin and First Streets

Parameter	Abbrev.	Units	Benzene	Toluene	Ethylbenzene	Xylenes	C11-C22 Aromatics	C9-C10 Aromatics	1,2,4-Trimethyl benzene	1,3,5-Trimethyl benzene
Henry's law constant[b]	H	unitless	2.3 E-1	2.7 E-1	3.2 E-1	3.0 E-1	3.0 E-2	3.3 E-1	2.3 E-1	3.2 E-1
Volumetric air content in vadose zone soils[b]	q_{as}	cm^3/cm^3	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
Volumetric air content in capillary fringe soils[b]	$q_{a,cap}$	cm^3/cm^3	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Volumetric water content in vadose zone soils[b]	q_{ws}	cm^3/cm^3	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Volumetric water content in capillary fringe soils[b]	$q_{w,cap}$	cm^3/cm^3	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34
Effective diffusion coefficient through capillary fringe[c]	$D_{eff,cap}$	cm^2/s	2.4 E-2	2.4 E-2	2.1 E-2	1.9 E-2	0.02	1.9 E-2	2.1 E-2	2.1 E-2
Effective diffusion coefficient in soil[d]	$D_{eff,s}$	cm^2/s	6.9 E-3	6.8 E-3	5.9 E-3	5.5 E-3	0.01	5.5 E-3	5.9 E-3	5.9 E-3
Groundwater/soil effective diffusion coefficient[e]	$D_{eff,ws}$	cm^2/s	7.0 E-3	6.9 E-3	6.0 E-3	5.6 E-3	0.01	5.6 E-3	6.0 E-3	6.0 E-3
Thickness of capillary fringe[b]	h_{cap}	cm	5	5	5	5	5	5	5	5
Thickness of vadose zone[f]	h_v	cm	193	193	193	193	193	193	193	193
Total soil porosity[b]	q_T	cm^3/cm^3	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Diffusion coefficent in water[b]	D_w	cm^2/s	9.8 E-6	8.6 E-6	7.8 E-6	7.8 E-6	1.0 E-5	1.0 E-5	7.9 E-6	7.9 E-6
Vapor phase diffusion coefficient in air[b]	D_{air}	cm^2/s	8.8 E-2	8.7 E-2	7.5 E-2	7.0 E-2	6.0 E-2	7.0 E-2	7.5 E-2	7.5 E-2
Wind speed above source parallel to groundwater flow[f]	U_{air}	cm/s	349	349	349	349	349	349	349	349
Ambient air mixing zone height[b]	d_{air}	cm	200	200	200	200	200	200	200	200
Width of source area parallel to groundwater flow[f]	W	cm	2.4 E+3	2.4 E+3	2.4 E+3	2.4 E+3	2.4 E+3	2.4 E+3	1.2 E+3	1.2 E+3
Soil bulk density[b]	r_s	g/cm^3	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Depth to groundwater[f]	L_{GW}	cm	198	198	198	198	198	198	198	198
Groundwater to ambient air volatilization factor[g]	VF_{am}	$(mg/m^3)/(mg/L)$	2.8 E-4	3.3 E-4	3.4 E-4	3.0 E-4	2.9 E-5	3.2 E-4	1.2 E-4	1.7 E-4
Concentration in groundwater[h]	C_{gw}	mg/L	0.87	0.29	7.0	3.5	300	1,300	7.7	1.6
RME Ambient air concentration[i]	C_{am}	mg/m^3	2.5 E-4	9.7 E-5	2.4 E-3	1.0 E-3	8.8 E-3	4.2 E-1	9.3 E-4	2.7 E-4

[a] ASTM, 1995.
[b] ASTM (1995) or USEPA (2003) default value.
[c] $D_a \times (\theta_{a,cap}^{3.33}/\theta_T^2) + D_w \times (1/H) \times (\theta_{w,cap}^{3.33}/\theta_T^2)$
[d] $D_a \times (\theta_{as}^{3.33}/\theta_T^2) + D_w \times (1/H) \times (\theta_{ws}^{3.33}/\theta_T^2)$
[e] $(h_{cap} + h_v)/[(h_{cap}/D_{eff,cap}) + (h_v/D_{s,eff})]$
[f] Based on site data.
[g] $1000\ L/m^3 \times H/[1 + (U_{air} \times d_{air} \times L_{GW})/(W \times D_{eff,ws})]$
[h] From Table 6
[i] $C_{gw} \times VF_{am}$

Table 9
Vapor Diffusion Model - Groundwater to Ambient Air [a]
Napa Lodgeworks Property
Franklin and First Streets

Parameter	Abbrev.	Units	Isopropylbenzene	n-propylbenzene	p-Isopropyltoluene	n-Butylbenzene	sec-Butylbenzene	Naphthalene
Henry's law constant[b]	H	unitless	4.3 E-1	4.3 E-1	4.3 E-1	5.4 E-1	7.7 E-1	2.0 E-2
Volumetric air content in vadose zone soils[b]	q_{as}	cm^3/cm^3	0.26	0.26	0.26	0.26	0.26	0.26
Volumetric air content in capillary fringe soils[b]	$q_{a,cap}$	cm^3/cm^3	0.38	0.38	0.38	0.38	0.38	0.38
Volumetric water content in vadose zone soils[b]	q_{ws}	cm^3/cm^3	0.12	0.12	0.12	0.12	0.12	0.12
Volumetric water content in capillary fringe soils[b]	$q_{w,cap}$	cm^3/cm^3	0.34	0.34	0.34	0.34	0.34	0.34
Effective diffusion coefficient through capillary fringe[c]	$D_{eff,cap}$	cm^2/s	2.1 E-2	2.1 E-2	2.1 E-2	2.1 E-2	2.1 E-2	1.6 E-2
Effective diffusion coefficient in soil[d]	$D_{eff,s}$	cm^2/s	5.9 E-3	5.9 E-3	5.9 E-3	5.9 E-3	5.9 E-3	4.6 E-3
Groundwater/soil effective diffusion coefficient[e]	$D_{eff,ws}$	cm^2/s	6.0 E-3	6.0 E-3	6.0 E-3	6.0 E-3	6.0 E-3	4.7 E-3
Thickness of capillary fringe[b]	h_{cap}	cm	5	5	5	5	5	5
Thickness of vadose zone[f]	h_v	cm	193	193	193	193	193	193
Total soil porosity[b]	q_T	cm^3/cm^3	0.38	0.38	0.38	0.38	0.38	0.38
Diffusion coefficent in water[b]	D_w	cm^2/s	7.8 E-6	7.8 E-6	7.8 E-6	7.8 E-6	7.8 E-6	7.5 E-6
Vapor phase diffusion coefficient in air[b]	D_{air}	cm^2/s	7.5 E-2	7.5 E-2	7.5 E-2	7.5 E-2	7.5 E-2	5.9 E-2
Wind speed above source parallel to groundwater flow[f]	U_{air}	cm/s	349	349	349	349	349	349
Ambient air mixing zone height[b]	d_{air}	cm	200	200	200	200	200	200
Width of source area parallel to groundwater flow[f]	W	cm	1.2 E+3	1.2 E+3	1.2 E+3	1.2 E+3	1.2 E+3	1.2 E+3
Soil bulk density[b]	r_s	g/cm^3	1.7	1.7	1.7	1.7	1.7	1.7
Depth to groundwater[f]	L_{GW}	cm	198	198	198	198	198	198
Groundwater to ambient air volatilization factor[g]	VF_{am}	$(mg/m^3)/(mg/L)$	2.3 E-4	2.3 E-4	2.3 E-4	2.8 E-4	4.0 E-4	8.2 E-6
Concentration in groundwater[h]	C_{gw}	mg/L	1.1	2.7	0.35	1.6	0.45	2.5
RME Ambient air concentration[i]	C_{am}	mg/m^3	2.5 E-4	6.1 E-4	7.9 E-5	4.5 E-4	1.8 E-4	2.0 E-5

[a] ASTM, 1995.

[b] ASTM (1995) or USEPA (2003) default value.

[c] $D_a \times (\theta_{a,cap}^{3.33}/\theta_T^2) + D_w \times (1/H) \times (\theta_{w,cap}^{3.33}/\theta_T^2)$

[d] $D_a \times (\theta_{as}^{3.33}/\theta_T^2) + D_w \times (1/H) \times (\theta_{ws}^{3.33}/\theta_T^2)$

[e] $(h_{cap} + h_v)/[(h_{cap}/D_{eff,cap}) + (h_v/D_{s,eff})]$

[f] Based on site data.

[g] $1000\ L/m^3 \times H/[1 + (U_{air} \times d_{air} \times L_{GW})/(W \times D_{eff,ws})]$

[h] From Table 6

[i] $C_{gw} \times VF_{am}$

Table 10

Calculating Dermal Absorption from Groundwater [a]

Napa Lodgeworks Property

Franklin and First Streets

Chemical	Organic Carbon Partition Coefficient (mL/g)	Log() Octanol Water Partinion Coefficient (dimensionless)	Molecular Weight (g/mole)	D_{sc} (cm^{-}/hr)	l_{sc} (cm)	Dermal Permeability Coefficient K_p (cm/hr)	Lag Time (hr/event) t	Time Steady State (hr) t*	B	Contact Time (hr)	Absorption DA_{water} (cm/event)
Benzene	62	2.18	78	6.36 E-7	0.001	1.5 E-2	0.29	0.70	0.10	1	0.02
Ethylbenzene	363	2.95	106	4.29 E-7	0.001	4.9 E-2	0.42	1.01	0.20	1	0.088
Toluene	140	2.53	92	5.23 E-7	0.001	3.1 E-2	0.35	0.84	0.10	1	0.05
Xylenes (total)	407	3.00	106	4.30 E-7	0.001	5.3 E-2	0.42	1.01	0.20	1	0.095
Total Petroleum Hydrocarbons-Diesel (TPH-D)											
C11-C22 Aromatics	5,000	4.09	150	2.32 E-7	0.001	3.9 E-1	0.72	5.10	1.83	1	0.913
C9-C18 Aliphatics	680,000	6.22	170	1.75 E-7	0.001	1.4 E+0	0.95	164.61	7.14	1	3.839
Total Petroleum Hydrocarbons-Gasoline (TPH-G)											
C9-C10 Aromatics	1,778	3.64	120	3.53 E-7	0.001	3.4 E-1	0.47	1.54	1.44	1	0.650
n-Butylbenzene	2,830	3.84	134	2.89 E-7	0.001	3.6 E-1	0.58	2.74	1.61	1	0.758
sec-Butylbenzene	2,150	3.72	134	2.89 E-7	0.001	3.3 E-1	0.58	2.10	1.49	1	0.701
Isopropylbenzene	220	2.73	120	3.53 E-7	0.001	1.9 E-1	0.47	-0.33	0.79	1	0.440
p-Isopropyltoluene	220	2.73	120	3.53 E-7	0.001	1.9 E-1	0.47	-0.33	0.79	1	0.440
n-Propylbenzene	2,830	3.84	134	2.89 E-7	0.001	3.6 E-1	0.58	2.74	1.61	1	0.758
1,3,5-Trimethylbenzene	819	3.30	120	3.52 E-7	0.001	2.7 E-1	0.47	0.54	1.16	1	0.664
1,2,4-Trimethylbenzene	3,720	3.96	120	3.52 E-7	0.001	4.2 E-1	0.47	3.08	1.78	1	0.804
Naphthalene	2,000	3.69	128	3.15 E-7	0.001	4.7 E-2	0.56	1.34	0.20	1	0.097

[a]Calculation from EPA (2001c). See text for explanation.

Table 11
Worker Exposure Parameters
Napa Lodgeworks Property
Franklin and First Streets

Parameter	Abbrev.	Units	RME Value	Rationale
Body Weight - Workers	BW_w	kg	70	USEPA, 2002
Averaging Time - Carcinogens	ATc	days	25,550	USEPA, 2002
Averaging Time - Noncarcinogens - Construction Worker	ATnc_cw	days	365	= ED x 365
Averaging Time - Noncarcinogens - Outdoor/Indoor Workers	ATnc_w	days	9125	= ED x 365
Exposure Frequency - Indoor Workers	EF_iw	days/yr	250	USEPA, 2002
Exposure Frequency - Construction Workers	EF_cw	days/yr	250	USEPA, 2002
Exposure Frequency to Groundwater - Construction Workers	EF_gw	days/yr	9	Means, 1987
Exposure Frequency - Maintenance Workers	EF_mw	days/yr	250	USEPA, 2002
Meteorological Factor	MET	unitless	1	
Exposure Duration - Outdoor/Indoor Workers	ED_w	years	25	USEPA, 2002
Exposure Duration - Construction Worker	ED_cw	years	1	Professional judgement
Exposure time - Construction Worker - Groundwater	ET_gw	hrs/day	1	Assumed value; also assumes 1 event per day
Soil Ingestion rate - Indoor Worker	IR_iw	mg/day	50	USEPA, 2002
Soil Ingestion rate - Maintenance Worker	IR_mw	mg/day	100	USEPA, 2002
Soil Ingestion rate - Construction Worker	IR_cw	mg/day	330	USEPA, 2002
Skin Surface Area for Soil Exposure - Maintenance/Construction W	SAs_m/cw	cm^2	3,300	USEPA, 2004
Soil Adherence Factor - Construction Worker	AF_cw	mg/cm^2	0.3	USEPA, 2004
Soil Adherence Factor - Maintenance Worker	AF_mw	mg/cm^2	0.2	USEPA, 2004
Unit Conversion 1	UC1	kg/mg	1.00E-06	
Unit Conversion 2	UC2	(l/cm^3)	1.00E-03	

kg kilograms
yr years
mg miligrams
cm^3 cubic centimeters
m^3 cubic meters
g grams

cm centimeters
ug micrograms
L liters

Table 12
Indoor Air Model Input Parameters - Groundwater to Indoor Air
Napa Lodgeworks Property
Franklin and First Streets

Parameter	Value
Interval 1 (0-1 feet)	
Depth Below grade to bottom of enclosed floor space (cm)	15
Depth to Groundwater (cm)	198.12
Average Soil Temperature (C)	17
Stratum Thickness (cm)	30.48
Vadose Zone Soil Type	S
Vadose Zone Dry Bulk Density (g/cm^3)	1.66
Vadose Zone Total Porosity (unitless)	0.38
Vadose Zone Water-Filled Porosity (unitless)	0.05
Interval 2 (2-5 feet)	
Stratum Thickness (cm)	167.64
Vadose Zone Soil Type	SI
Vadose Zone Dry Bulk Density (g/cm^3)	1.35
Vadose Zone Total Porosity (unitless)	0.49
Vadose Zone Water-Filled Porosity (unitless)	0.17
Building Characteristics	
Enclosed space floor thickness (cm)	10
Soil-building pressure differential ($g/cm\text{-}s^2$)	40
Enclosed space floor length (cm)	1000
Enclosed space floor width (cm)	1000
Enclosed space height (cm)	366
Floor-wall seam crack width (cm)	0.1
Indoor air exchange rate (1/hr)	1.8

Table 13
Indoor Air Model Input Parameters - Soil to Indoor Air
Napa Lodgeworks Property
Franklin and First Streets

Parameter	Value
Interval 1 (0-1 feet)	
Depth Below grade to bottom of enclosed floor space (cm)	15
Depth to Top of soil contamination (cm)	152.4
Depth to Bottom of soil contamination (cm)*	198.12
Average Soil Temperature (C)	17
Stratum Thickness (cm)	30.48
Vadose Zone Soil Type	S
Vadose Zone Dry Bulk Density (g/cm^3)	1.66
Vadose Zone Total Porosity (unitless)	0.38
Vadose Zone Water-Filled Porosity (unitless)	0.05
Interval 2 (2-5 feet)	
Stratum Thickness (cm)	121.92
Vadose Zone Soil Type	SI
Vadose Zone Dry Bulk Density (g/cm^3)	1.35
Vadose Zone Total Porosity (unitless)	0.49
Vadose Zone Water-Filled Porosity (unitless)	0.17
Building Characteristics	
Enclosed space floor thickness (cm)	10
Soil-building pressure differential ($g/cm\text{-}s^2$)	40
Enclosed space floor length (cm)	1000
Enclosed space floor width (cm)	1000
Enclosed space height (cm)	366
Floor-wall seam crack width (cm)	0.1
Indoor air exchange rate (1/hr)	1.8

* Depth to bottom of soil contamination is depth to groundwater. Contributions to indoor air from the saturated zone is assessed by groundwater to indoor air model.

Table 14
Risk Assessment Results – Maintenance Worker - Soil
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Concentration Soil Cs (mg/kg)	VF/PEF (m^3/kg)	Air Ca (mg/m^3)	Ingestion ADD/LADD (SEDo) (mg/kg-day)	Dermal Absorption (ABSd) (unitless)	Dermal ADD/LADD (SEDd) (mg/kg-day)	Inhalation Outdoor (ExCi) (mg/m^3)	Toxicity Values Oral	Dermal	Inhalation	Oral Risk/HI	Dermal Risk/HI	Inhalation Risk/HI	Total Risk/HI
CANCER EFFECTS								CSFo	CSFd	URF				
TPH-Mo	56													
C19-C36 Aliphatics	56	1.4 E+9	4.1 E-8	2.0 E-5	0.10	1.3 E-5	1.0 E-8	NA	NA	NA	NC	NC	NC	NC
TPH-D	50													
C11-C22 Aromatics	30	7.7 E+4	3.9 E-4	1.0 E-5	0.10	6.9 E-6	9.5 E-5	NA	NA	NA	NC	NC	NC	NC
C9-C18 Aliphatics	20	1.7 E+4	1.2 E-3	7.0 E-6	0.10	4.6 E-6	2.8 E-4	NA	NA	NA	NC	NC	NC	NC
TPH-G	198													
C9-C10 Aromatics	198	1.3 E+4	1.5 E-2	6.9 E-5	0.10	4.6 E-5	3.8 E-3	NA	NA	NA	NC	NC	NC	NC
Benzene	1.00	3.0 E+3	3.3 E-4	3.5 E-7	0.10	2.3 E-7	8.1 E-5	1.0 E-1	1.0 E-1	2.9 E-5	3 E-8	2 E-8	2 E-6	2 E-6
Toluene	0.48	4.3 E+3	1.1 E-4	1.7 E-7	0.10	1.1 E-7	2.7 E-5	NA	NA	NA	NC	NC	NC	NC
Ethylbenzene	2.76	5.9 E+3	4.7 E-4	9.7 E-7	0.10	6.4 E-7	1.2 E-4	NA	NA	NA	NC	NC	NC	NC
Total Xylenes	12	6.4 E+3	1.9 E-3	4.2 E-6	0.10	2.8 E-6	4.6 E-4	NA	NA	NA	NC	NC	NC	NC
n-Butylbenzene	0.11	1.2 E+4	8.9 E-6	3.8 E-8	0.10	2.5 E-8	2.2 E-6	NA	NA	NA	NC	NC	NC	NC
sec-Butylbenzene	0.04	9.0 E+3	4.0 E-6	1.3 E-8	0.10	8.3 E-9	9.8 E-7	NA	NA	NA	NC	NC	NC	NC
Isopropylbenzene	0.07	4.1 E+3	1.6 E-5	2.3 E-8	0.10	1.5 E-8	4.0 E-6	NA	NA	NA	NC	NC	NC	NC
p-Isopropyltoluene	0.02	4.1 E+3	4.9 E-6	7.0 E-9	0.10	4.6 E-9	1.2 E-6	NA	NA	NA	NC	NC	NC	NC
Methylene Chloride	0.02	2.8 E+3	8.5 E-6	8.4 E-9	0.10	5.5 E-9	2.1 E-6	1.4 E-2	1.4 E-2	1.0 E-6	1 E-10	8 E-11	2 E-9	2 E-9
Naphthalene	0.18	4.7 E+4	3.8 E-6	6.3 E-8	0.10	4.2 E-8	9.4 E-7	NA	NA	NA	NC	NC	NC	NC
n-Propylbenzene	0.20	1.4 E+4	1.5 E-5	7.0 E-8	0.10	4.6 E-8	3.6 E-6	NA	NA	NA	NC	NC	NC	NC
1,3,5-Trimethylbenzene	0.23	8.7 E+3	2.6 E-5	8.0 E-8	0.10	5.3 E-8	6.4 E-6	NA	NA	NA	NC	NC	NC	NC
1,2,4-Trimethylbenzene	1.30	2.2 E+4	6.0 E-5	4.5 E-7	0.10	3.0 E-7	1.5 E-5	NA	NA	NA	NC	NC	NC	NC
									Total Cancer Risk		**4 E-8**	**2 E-8**	**2 E-6**	**2 E-6**

Table 14
Risk Assessment Results – Maintenance Worker - Soil
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Concentration Soil Cs (mg/kg)	VF/PEF (m^3/kg)	Air Ca (mg/m^3)	Ingestion ADD/LADD (SEDo) (mg/kg-day)	Dermal Absorption (ABSd) (unitless)	Dermal ADD/LADD (SEDd) (mg/kg-day)	Inhalation Outdoor (ExCi) (mg/m^3)	Toxicity Values Oral	Toxicity Values Dermal	Toxicity Values Inhalation	Oral Risk/HI	Dermal Risk/HI	Inhalation Risk/HI	Total Risk/HI
NON-CANCER EFFECTS								RfDo	RfDd	RfC				
TPH-Mo	56													
C19-C36 Aliphatics	56	1.4 E+9	4.1 E-8	5.5 E-5	0.10	3.6 E-5	2.8 E-8	2.0 E+0	2.0 E+0	NA	2.7 E-5	1.8 E-5	NC	4.5 E-5
TPH-D	50													
C11-C22 Aromatics	30	7.7 E+4	3.9 E-4	2.9 E-5	0.10	1.9 E-5	2.7 E-4	3.0 E-2	3.0 E-2	5.0 E-2	9.8 E-4	6.5 E-4	5.3 E-3	7.0 E-3
C9-C18 Aliphatics	20	1.7 E+4	1.2 E-3	2.0 E-5	0.10	1.3 E-5	7.9 E-4	1.0 E-1	1.0 E-1	2.0 E-1	2.0 E-4	1.3 E-4	3.9 E-3	4.3 E-3
TPH-G	198													
C9-C10 Aromatics	198	1.3 E+4	1.5 E-2	1.9 E-4	0.10	1.3 E-4	1.1 E-2	3.0 E-2	3.0 E-2	5.0 E-2	6.5 E-3	4.3 E-3	2.1 E-1	2.2 E-1
Benzene	1.0	3.0 E+3	3.3 E-4	9.8 E-7	0.10	6.5 E-7	2.3 E-4	4.0 E-3	4.0 E-3	3.0 E-2	2.4 E-4	1.6 E-4	7.6 E-3	8.0 E-3
Toluene	0.5	4.3 E+3	1.1 E-4	4.7 E-7	0.10	3.1 E-7	7.5 E-5	8.0 E-2	8.0 E-2	5.0 E+0	5.8 E-6	3.8 E-6	1.5 E-5	2.5 E-5
Ethylbenzene	2.8	5.9 E+3	4.7 E-4	2.7 E-6	0.10	1.8 E-6	3.2 E-4	1.0 E-1	1.0 E-1	1.0 E+0	2.7 E-5	1.8 E-5	3.2 E-4	3.7 E-4
Total Xylenes	12.1	6.4 E+3	1.9 E-3	1.2 E-5	0.10	7.8 E-6	1.3 E-3	2.0 E-1	2.0 E-1	1.0 E-1	5.9 E-5	3.9 E-5	1.3 E-2	1.3 E-2
n-Butylbenzene	0.11	1.2 E+4	8.9 E-6	1.1 E-7	0.10	7.1 E-8	6.1 E-6	4.0 E-2	4.0 E-2	1.4 E-1	2.7 E-6	1.8 E-6	4.4 E-5	4.8 E-5
sec-Butylbenzene	0.04	9.0 E+3	4.0 E-6	3.5 E-8	0.10	2.3 E-8	2.7 E-6	4.0 E-2	4.0 E-2	1.4 E-1	8.8 E-7	5.8 E-7	2.0 E-5	2.1 E-5
Isopropylbenzene	0.07	4.1 E+3	1.6 E-5	6.5 E-8	0.10	4.3 E-8	1.1 E-5	1.0 E-1	1.0 E-1	3.9 E-1	6.5 E-7	4.3 E-7	2.9 E-5	3.0 E-5
p-Isopropyltoluene	0.02	4.1 E+3	4.9 E-6	2.0 E-8	0.10	1.3 E-8	3.4 E-6	NA	NA	NA	NC	NC	NC	NC
Methylene Chloride	0.02	2.8 E+3	8.5 E-6	2.3 E-8	0.10	1.5 E-8	5.9 E-6	6.0 E-2	6.0 E-2	4.0 E-1	3.9 E-7	2.6 E-7	1.5 E-5	1.5 E-5
Naphthalene	0.18	4.7 E+4	3.8 E-6	1.8 E-7	0.10	1.2 E-7	2.6 E-6	2.0 E-2	2.0 E-2	3.0 E-3	8.8 E-6	5.8 E-6	8.8 E-4	8.9 E-4
n-Propylbenzene	0.20	1.4 E+4	1.5 E-5	2.0 E-7	0.10	1.3 E-7	1.0 E-5	1.0 E-1	1.0 E-1	3.9 E-1	2.0 E-6	1.3 E-6	2.6 E-5	2.9 E-5
1,3,5-Trimethylbenzene	0.23	8.7 E+3	2.6 E-5	2.3 E-7	0.10	1.5 E-7	1.8 E-5	5.0 E-2	5.0 E-2	6.0 E-3	4.5 E-6	3.0 E-6	3.0 E-3	3.0 E-3
1,2,4-Trimethylbenzene	1.3	2.2 E+4	6.0 E-5	1.3 E-6	0.10	8.4 E-7	4.1 E-5	5.0 E-2	5.0 E-2	6.0 E-3	2.5 E-5	1.7 E-5	7.0 E-3	7.0 E-3
									Total Hazard Index		**0.0080**	**0.0053**	**0.25**	**0.26**

Cs = Concentration of chemical in soil
SEDo = Soil exposure dose, oral route
SEDd = Soil exposure dose, dermal route
ExCi = Exposure concentration, inhalation route
NA = Not available.
NC = Not calculated.

CSFo = Cancer Slope Factor, Oral $(mg/kg\text{-}day)^{-1}$
CSFd = Cancer Slope Factor, Dermal $(mg/kg\text{-}day)^{-1}$
URF = Unit Risk Factor, $(mg/m^3)^{-1}$
RfDo = Reference Dose, Oral (mg/kg-day)
RfDd = Reference Dose, Dermal (mg/kg-day)
RfC = Reference Concentration (mg/m^3)

Table 15
Risk Assessment Results – Maintenance Worker - Groundwater
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Concentration Groundwater Cgw (ug/L)	Air Ca (mg/m^3)	Inhalation Outdoor (ExCi) (mg/m^3)	Toxicity Values Inhalation	Inhalation Risk/HI	Total Risk/HI
CANCER EFFECTS				URF		
TPH-Mo	450,000	NA				
C19-C36 Aliphatics	450,000	NA	NA	NA	NC	NC
TPH-D	300,000					
C11-C22 Aromatics	300,000	8.8 E-3	2.2 E-3	NA	NC	NC
C9-C18 Aliphatics	NA	NA	NA	NA	NC	NC
TPH-G	1,300,000					
C9-C10 Aromatics	1,300,000	4.2 E-1	1.0 E-1	NA	NC	NC
Benzene	870	2.5 E-4	6.0 E-5	2.9 E-5	2 E-6	2 E-6
Toluene	294	9.7 E-5	2.4 E-5	NA	NC	NC
Ethylbenzene	7,000	2.4 E-3	5.8 E-4	NA	NC	NC
Total Xylenes	3,507	1.0 E-3	2.5 E-4	NA	NC	NC
n-Butylbenzene	1,600	4.5 E-4	1.1 E-4	NA	NC	NC
sec-Butylbenzene	450	1.8 E-4	4.4 E-5	NA	NC	NC
Isopropylbenzene	1,100	2.5 E-4	6.1 E-5	NA	NC	NC
p-Isopropyltoluene	350	7.9 E-5	1.9 E-5	NA	NC	NC
Naphthalene	2,500	2.0 E-5	5.0 E-6	NA	NC	NC
n-Propylbenzene	2,700	6.1 E-4	1.5 E-4	NA	NC	NC
1,3,5-Trimethylbenzer	1,600	2.7 E-4	6.5 E-5	NA	NC	NC
1,2,4-Trimethylbenzer	7,700	9.3 E-4	2.3 E-4	NA	NC	NC
				Total Cancer Risk	**2 E-6**	**2 E-6**
NON-CANCER EFFECTS				RfC		
TPH-Mo	450,000					
C19-C36 Aliphatics	450,000	NA	NA	NA	NA	NC
TPH-D	300,000					
C11-C22 Aromatics	300,000	8.8 E-3	6.1 E-3	5.0 E-2	1.2 E-1	1.2 E-1
C9-C18 Aliphatics	NA	NA	NA	2.0 E-1	NA	NC
TPH-G	1,300,000					
C9-C10 Aromatics	1,300,000	4.2 E-1	2.9 E-1	5.0 E-2	5.8 E+0	5.8 E+0
Benzene	870	2.5 E-4	1.7 E-4	3.0 E-2	5.6 E-3	5.6 E-3
Toluene	294	9.7 E-5	6.7 E-5	5.0 E+0	1.3 E-5	1.3 E-5
Ethylbenzene	7,000	2.4 E-3	1.6 E-3	1.0 E+0	1.6 E-3	1.6 E-3
Total Xylenes	3,507	1.0 E-3	7.1 E-4	1.0 E-1	NA	NC
n-Butylbenzene	1,600	4.5 E-4	3.1 E-4	1.4 E-1	2.2 E-3	2.2 E-3
sec-Butylbenzene	450	1.8 E-4	1.2 E-4	1.4 E-1	8.9 E-4	8.9 E-4
Isopropylbenzene	1,100	2.5 E-4	1.7 E-4	3.9 E-1	4.4 E-4	4.4 E-4
p-Isopropyltoluene	350	7.9 E-5	5.4 E-5	NA	NC	NC
Naphthalene	2,500	2.0 E-5	1.4 E-5	3.0 E-3	4.7 E-3	4.7 E-3
n-Propylbenzene	2,700	6.1 E-4	4.2 E-4	3.9 E-1	1.1 E-3	1.1 E-3
1,3,5-Trimethylbenzer	1,600	2.7 E-4	1.8 E-4	6.0 E-3	3.1 E-2	3.1 E-2
1,2,4-Trimethylbenzer	7,700	9.3 E-4	6.4 E-4	6.0 E-3	1.1 E-1	1.1 E-1
				Total Hazard Index	**6.0**	**6.0**

Cs = Concentration of chemical in soil
ExCi = Exposure concentration, inhalation route
NA = Not available.
NC = Not calculated.

Table 16
Risk Assessment Results – Indoor Commercial/Industrial (Hotel) Worker - Soil
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Concentration Soil Cs (mg/kg)	Concentration Air Ca (mg/m^3)	Ingestion ADD/LADD (SEDo) (mg/kg-day)	Dermal Absorption (ABSd) (unitless)	Dermal ADD/LADD (SEDd) (mg/kg-day)	Inhalation Indoor (ExCi) (mg/m^3)	Toxicity Values Oral	Toxicity Values Dermal	Toxicity Values Inhalation	Oral Risk/HI	Dermal Risk/HI	Inhalation Risk/HI	Total Risk/HI
CANCER EFFECTS							CSFo	CSFd	URF				
TPH-Mo	56		9.8E-06										
C19-C36 Aliphatics	56	NC	9.8E-06	0.10	NC	NC	NA	NA	NA	NC	NC	NC	NC
TPH-D	50		8.7E-06										
C11-C22 Aromatics	30	6.57E-03	5.2E-06	0.10	NC	1.6 E-3	NA	NA	NA	NC	NC	NC	NC
C9-C18 Aliphatics	20	6.20E-03	3.5E-06	0.10	NC	1.5 E-3	NA	NA	NA	NC	NC	NC	NC
TPH-G	198		3.5E-05										
C9-C10 Aromatics	198	5.74E-02	3.5E-05	0.10	NC	1.4 E-2	NA	NA	NA	NC	NC	NC	NC
Benzene	1.00	3.02E-04	1.7E-07	0.10	NC	7.4 E-5	1.0 E-1	1.0 E-1	2.9 E-5	2 E-8	NC	2 E-6	2 E-6
Toluene	0.48	1.44E-04	8.3E-08	0.10	NC	3.5 E-5	NA	NA	NA	NC	NC	NC	NC
Ethylbenzene	2.76	8.36E-04	4.8E-07	0.10	NC	2.0 E-4	NA	NA	NA	NC	NC	NC	NC
Total Xylenes	12.05	3.64E-03	2.1E-06	0.10	NC	8.9 E-4	NA	NA	NA	NC	NC	NC	NC
n-Butylbenzene	0.11	3.33E-05	1.9E-08	0.10	NC	8.1 E-6	NA	NA	NA	NC	NC	NC	NC
sec-Butylbenzene	0.04	1.02E-05	6.3E-09	0.10	NC	2.5 E-6	NA	NA	NA	NC	NC	NC	NC
Isopropylbenzene	0.07	2.00E-05	1.2E-08	0.10	NC	4.9 E-6	NA	NA	NA	NC	NC	NC	NC
p-Isopropyltoluene	0.02	6.05E-06	3.5E-09	0.10	NC	1.5 E-6	NA	NA	NA	NC	NC	NC	NC
Methylene Chloride	0.02	1.09E-05	4.2E-09	0.10	NC	2.7 E-6	1.4 E-2	1.4 E-2	1.0 E-6	6 E-11	NC	3 E-9	3 E-9
Naphthalene	0.18	5.44E-05	3.1E-08	0.10	NC	1.3 E-5	NA	NA	NA	NC	NC	NC	NC
n-Propylbenzene	0.20	6.05E-05	3.5E-08	0.10	NC	1.5 E-5	NA	NA	NA	NC	NC	NC	NC
1,3,5-Trimethylbenze	0.23	6.95E-05	4.0E-08	0.10	NC	1.7 E-5	NA	NA	NA	NC	NC	NC	NC
1,2,4-Trimethylbenze	1.30	6.95E-05	2.3E-07	0.10	NC	1.7 E-5	NA	NA	NA	NC	NC	NC	NC
								Total Cancer Risk		**2 E-8**	**NC**	**2 E-6**	**2 E-6**

Table 16
Risk Assessment Results – Indoor Commercial/Industrial (Hotel) Worker - Soil
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Concentration Soil Cs (mg/kg)	Air Ca (mg/m^3)	Ingestion ADD/LADD (SEDo) (mg/kg-day)	Dermal Absorption (ABSd) (unitless)	Dermal ADD/LADD (SEDd) (mg/kg-day)	Inhalation Indoor (ExCi) (mg/m^3)	Toxicity Values Oral	Dermal	Inhalation	Oral Risk/HI	Dermal Risk/HI	Inhalation Risk/HI	Total Risk/HI
NON-CANCER EFFECTS							RfDo	RfDd	RfC				
TPH-Mo	56												
C19-C36 Aliphatics	56	NC	2.7E-05	0.10	NC	NC	2.0 E+0	2.0 E+0	NA	1.4 E-5	NC	NA	1.4 E-5
TPH-D	50		2.4E-05	0.10									
C11-C22 Aromatics	30	6.6E-03	1.5E-05	0.10	NC	4.5 E-3	3.0 E-2	3.0 E-2	5.0 E-2	4.9 E-4	NC	9.0 E-2	9.0 E-2
C9-C18 Aliphatics	20	6.2E-03	9.8E-06	0.10	NC	4.2 E-3	1.0 E-1	1.0 E-1	2.0 E-1	9.8 E-5	NC	2.1 E-2	2.1 E-2
TPH-G	198		9.7E-05	0.10									
C9-C10 Aromatics	198	5.7E-02	9.7E-05	0.10	NC	3.9 E-2	3.0 E-2	3.0 E-2	5.0 E-2	3.2 E-3	NC	7.9 E-1	7.9 E-1
Benzene	1.0	3.0E-04	4.9E-07	0.10	NC	2.1 E-4	4.0 E-3	4.0 E-3	3.0 E-2	1.2 E-4	NC	6.9 E-3	7.0 E-3
Toluene	0.5	1.4E-04	2.3E-07	0.10	NC	9.9 E-5	8.0 E-2	8.0 E-2	5.0 E+0	2.9 E-6	NC	2.0 E-5	2.3 E-5
Ethylbenzene	2.8	8.4E-04	1.4E-06	0.10	NC	5.7 E-4	1.0 E-1	1.0 E-1	1.0 E+0	1.4 E-5	NC	5.7 E-4	5.9 E-4
Total Xylenes	12.1	3.6E-03	5.9E-06	0.10	NC	2.5 E-3	2.0 E-1	2.0 E-1	1.0 E-1	2.9 E-5	NC	NA	2.9 E-5
n-Butylbenzene	0.11	3.3E-05	5.4E-08	0.10	NC	2.3 E-5	4.0 E-2	4.0 E-2	1.4 E-1	1.3 E-6	NC	1.6 E-4	1.6 E-4
sec-Butylbenzene	0.04	1.0E-05	1.8E-08	0.10	NC	7.0 E-6	4.0 E-2	4.0 E-2	1.4 E-1	4.4 E-7	NC	5.0 E-5	5.0 E-5
Isopropylbenzene	0.07	2.0E-05	3.2E-08	0.10	NC	1.4 E-5	1.0 E-1	1.0 E-1	3.9 E-1	3.2 E-7	NC	3.5 E-5	3.6 E-5
p-Isopropyltoluene	0.02	6.0E-06	9.8E-09	0.10	NC	4.1 E-6	NA	NA	NA	NC	NC	NC	NC
Methylene Chloride	0.02	1.1E-05	1.2E-08	0.10	NC	7.5 E-6	6.0 E-2	6.0 E-2	4.0 E-1	2.0 E-7	NC	1.9 E-5	1.9 E-5
Naphthalene	0.18	5.4E-05	8.8E-08	0.10	NC	3.7 E-5	2.0 E-2	2.0 E-2	3.0 E-3	4.4 E-6	NC	1.2 E-2	1.2 E-2
n-Propylbenzene	0.20	6.0E-05	9.8E-08	0.10	NC	4.1 E-5	1.0 E-1	1.0 E-1	3.9 E-1	9.8 E-7	NC	1.1 E-4	1.1 E-4
1,3,5-Trimethylbenze	0.23	7.0E-05	1.1E-07	0.10	NC	4.8 E-5	5.0 E-2	5.0 E-2	6.0 E-3	2.3 E-6	NC	8.0 E-3	8.0 E-3
1,2,4-Trimethylbenze	1.3	7.0E-05	6.4E-07	0.10	NC	4.8 E-5	5.0 E-2	5.0 E-2	6.0 E-3	1.3 E-5	NC	8.0 E-3	8.0 E-3
								Total Hazard Index		**0.0040**	**NC**	**0.93**	**0.94**

Cs = Concentration of chemical in soil
SEDo = Soil exposure dose, oral route
SEDd = Soil exposure dose, dermal route
ExCi = Exposure concentration, inhalation route
NA = Not available.
NC = Not calculated.

CSFo = Cancer Slope Factor, Oral $(mg/kg\text{-}day)^{-1}$
CSFd = Cancer Slope Factor, Dermal $(mg/kg\text{-}day)^{-1}$
URF = Unit Risk Factor, $(mg/m^3)^{-1}$
RfDo = Reference Dose, Oral (mg/kg-day)
RfDd = Reference Dose, Dermal (mg/kg-day)
RfC = Reference Concentration (mg/m^3)

Table 17
Risk Assessment Results – Indoor Commercial/Industrial (Hotel) Worker - Groundwater
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Concentration Groundwater Cs (ug/L)	Concentration Air Ca (mg/m^3)	Inhalation Indoor (ExCi) (mg/m^3)	Toxicity Values Inhalation	Inhalation Risk/HI	Total Risk/HI
CANCER EFFECTS				URF		
TPH-Mo	450,000					
C19-C36 Aliphatics	450,000	NC	NC	NA	NC	NC
TPH-D	300,000					
C11-C22 Aromatics	300,000	7.5E-04	1.8 E-4	NA	NC	NC
C9-C18 Aliphatics	NA	NC	NC	NA	NC	NC
TPH-G	1,300,000					
C9-C10 Aromatics	1,300,000	6.2E-02	1.5 E-2	NA	NC	NC
Benzene	870	1.1E-03	2.7 E-4	2.9 E-5	8 E-6	8 E-6
Toluene	294	4.1E-04	1.0 E-4	NA	NC	NC
Ethylbenzene	7,000	9.5E-03	2.3 E-3	NA	NC	NC
Total Xylenes	3,507	3.7E-03	9.0 E-4	NA	NC	NC
n-Butylbenzene	1,600	2.5E-03	6.2 E-4	NA	NC	NC
sec-Butylbenzene	450	2.8E-05	6.8 E-6	NA	NC	NC
Isopropylbenzene	1,100	2.1E-03	5.2 E-4	NA	NC	NC
p-Isopropyltoluene	350	6.7E-04	1.6 E-4	NA	NC	NC
Naphthalene	2,500	2.5E-04	6.1 E-5	NA	NC	NC
n-Propylbenzene	2,700	3.8E-03	9.2 E-4	NA	NC	NC
1,3,5-Trimethylbenzene	1,600	1.3E-03	3.1 E-4	NA	NC	NC
1,2,4-Trimethylbenzene	7,700	6.3E-03	1.5 E-3	NA	NC	NC
				Total Cancer Risk	**8 E-6**	**8 E-6**
NON-CANCER EFFECTS				RfC		
TPH-Mo	450,000					
C19-C36 Aliphatics	450,000	NC	NC	NA	NA	NC
TPH-D	300,000					
C11-C22 Aromatics	300,000	7.5E-04	5.2 E-4	5.0 E-2	1.0 E-2	1.0 E-2
C9-C18 Aliphatics	NA	NC	NC	2.0 E-1	NA	NC
TPH-G	1,300,000					
C9-C10 Aromatics	1,300,000	6.2E-02	4.2 E-2	5.0 E-2	8.5 E-1	8.5 E-1
Benzene	870	1.1E-03	7.5 E-4	3.0 E-2	2.5 E-2	2.5 E-2
Toluene	294	4.1E-04	2.8 E-4	5.0 E+0	5.6 E-5	5.6 E-5
Ethylbenzene	7,000	9.5E-03	6.5 E-3	1.0 E+0	6.5 E-3	6.5 E-3
Total Xylenes	3,507	3.7E-03	2.5 E-3	1.0 E-1	2.5 E-2	2.5 E-2
n-Butylbenzene	1,600	2.5E-03	1.7 E-3	1.4 E-1	1.2 E-2	1.2 E-2
sec-Butylbenzene	450	2.8E-05	1.9 E-5	1.4 E-1	1.4 E-4	1.4 E-4
Isopropylbenzene	1,100	2.1E-03	1.5 E-3	3.9 E-1	3.8 E-3	3.8 E-3
p-Isopropyltoluene	350	6.7E-04	4.6 E-4	NA	NC	NC
Naphthalene	2,500	2.5E-04	1.7 E-4	3.0 E-3	5.7 E-2	5.7 E-2
n-Propylbenzene	2,700	3.8E-03	2.6 E-3	3.9 E-1	6.7 E-3	6.7 E-3
1,3,5-Trimethylbenzene	1,600	1.3E-03	8.6 E-4	6.0 E-3	1.4 E-1	1.4 E-1
1,2,4-Trimethylbenzene	7,700	6.3E-03	4.3 E-3	6.0 E-3	7.3 E-1	7.3 E-1
				Total Hazard Index	**1.9**	**1.9**

Cs = Concentration of chemical in soil
ExCi = Exposure concentration, inhalation route
NA = Not available.
NC = Not calculated.

Table 18
Risk Assessment Results – Construction Worker - Soil
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Concentration Soil Cs (mg/kg)	VF/PEF (m^3/kg)	Air Ca (mg/m^3)	Ingestion ADD/LADD (SEDo) (mg/kg-day)	Dermal Absorption (ABSd) (unitless)	Dermal ADD/LADD (SEDd) (mg/kg-day)	Inhalation (ExCi) (mg/m^3)	Toxicity Values Oral	Dermal	Inhalation	Oral Risk/HI	Dermal Risk/HI	Inhalation Risk/HI	Total Risk/HI
CANCER EFFECTS								CSFo	CSFd	URF				
TPH-Mo	56													
C19-C36 Aliphatics	56	1.4 E+9	4.1 E-8	2.6 E-6	0.10	7.7 E-7	4.0 E-10	NA	NA	NA	NC	NC	NC	NC
TPH-D	50													
C11-C22 Aromatics	30	7.7 E+4	3.9 E-4	1.4 E-6	0.10	4.2 E-7	3.8 E-6	NA	NA	NA	NC	NC	NC	NC
C9-C18 Aliphatics	20	1.7 E+4	1.2 E-3	9.2 E-7	0.10	2.8 E-7	1.1 E-5	NA	NA	NA	NC	NC	NC	NC
TPH-G	198													
C9-C10 Aromatics	198	1.3 E+4	1.5 E-2	9.1 E-6	0.10	2.7 E-6	1.5 E-4	NA	NA	NA	NC	NC	NC	NC
Benzene	1.00	3.0 E+3	3.3 E-4	4.6 E-8	0.10	1.4 E-8	3.3 E-6	1.0 E-1	1.0 E-1	2.9 E-5	5 E-9	1 E-9	9 E-8	1 E-7
Toluene	0.48	4.3 E+3	1.1 E-4	2.2 E-8	0.10	6.6 E-9	1.1 E-6	NA	NA	NA	NC	NC	NC	NC
Ethylbenzene	2.76	5.9 E+3	4.7 E-4	1.3 E-7	0.10	3.8 E-8	4.6 E-6	NA	NA	NA	NC	NC	NC	NC
Total Xylenes	12.05	6.4 E+3	1.9 E-3	5.6 E-7	0.10	1.7 E-7	1.8 E-5	NA	NA	NA	NC	NC	NC	NC
n-Butylbenzene	0.11	1.2 E+4	8.9 E-6	5.1 E-9	0.10	1.5 E-9	8.7 E-8	NA	NA	NA	NC	NC	NC	NC
sec-Butylbenzene	0.04	9.0 E+3	4.0 E-6	1.7 E-9	0.10	5.0 E-10	3.9 E-8	NA	NA	NA	NC	NC	NC	NC
Isopropylbenzene	0.07	4.1 E+3	1.6 E-5	3.0 E-9	0.10	9.1 E-10	1.6 E-7	NA	NA	NA	NC	NC	NC	NC
p-Isopropyltoluene	0.02	4.1 E+3	4.9 E-6	9.2 E-10	0.10	2.8 E-10	4.8 E-8	NA	NA	NA	NC	NC	NC	NC
Methylene Chloride	0.02	2.8 E+3	8.5 E-6	1.1 E-9	0.10	3.3 E-10	8.4 E-8	1.4 E-2	1.4 E-2	1.0 E-6	2 E-11	5 E-12	8 E-11	1 E-10
Naphthalene	0.18	4.7 E+4	3.8 E-6	8.3 E-9	0.10	2.5 E-9	3.8 E-8	NA	NA	NA	NC	NC	NC	NC
n-Propylbenzene	0.20	1.4 E+4	1.5 E-5	9.2 E-9	0.10	2.8 E-9	1.4 E-7	NA	NA	NA	NC	NC	NC	NC
1,3,5-Trimethylbenzene	0.23	8.7 E+3	2.6 E-5	1.1 E-8	0.10	3.2 E-9	2.6 E-7	NA	NA	NA	NC	NC	NC	NC
1,2,4-Trimethylbenzene	1.30	2.2 E+4	6.0 E-5	6.0 E-8	0.10	1.8 E-8	5.9 E-7	NA	NA	NA	NC	NC	NC	NC
								Total Cancer Risk			**5 E-9**	**1 E-9**	**9 E-8**	**1 E-7**

Table 18
Risk Assessment Results – Construction Worker - Soil
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Concentration Soil Cs (mg/kg)	Concentration VF/PEF (m^3/kg)	Concentration Air Ca (mg/m^3)	Ingestion ADD/LADD (SEDo) (mg/kg-day)	Dermal Absorption (ABSd) (unitless)	Dermal ADD/LADD (SEDd) (mg/kg-day)	Inhalation (ExCi) (mg/m^3)	Toxicity Values Oral	Toxicity Values Dermal	Toxicity Values Inhalation	Oral Risk/HI	Dermal Risk/HI	Inhalation Risk/HI	Total Risk/HI
NON-CANCER EFFECTS								RfDo	RfDd	RfC				
TPH-Mo	56													
C19-C36 Aliphatics	56	1.4 E+9	4.1 E-8	1.8 E-4	0.10	5.4 E-5	2.8 E-8	2.0 E+0	2.0 E+0	NA	9.0 E-5	2.7 E-5	NC	1.2 E-4
TPH-D	50													
C11-C22 Aromatics	30	7.7 E+4	3.9 E-4	9.7 E-5	0.10	2.9 E-5	2.7 E-4	3.0 E-2	3.0 E-2	5.0 E-2	3.2 E-3	9.7 E-4	5.3 E-3	9.5 E-3
C9-C18 Aliphatics	20	1.7 E+4	1.2 E-3	6.5 E-5	0.10	1.9 E-5	7.9 E-4	1.0 E-1	1.0 E-1	2.0 E-1	6.5 E-4	1.9 E-4	3.9 E-3	4.8 E-3
TPH-G	198													
C9-C10 Aromatics	198	1.3 E+4	1.5 E-2	6.4 E-4	0.10	1.9 E-4	1.1 E-2	3.0 E-2	3.0 E-2	5.0 E-2	2.1 E-2	6.4 E-3	2.1 E-1	2.4 E-1
Benzene	1.00	3.0 E+3	3.3 E-4	3.2 E-6	0.10	9.7 E-7	2.3 E-4	4.0 E-3	4.0 E-3	3.0 E-2	8.1 E-4	2.4 E-4	7.6 E-3	8.7 E-3
Toluene	0.48	4.3 E+3	1.1 E-4	1.5 E-6	0.10	4.6 E-7	7.5 E-5	8.0 E-2	8.0 E-2	5.0 E+0	1.9 E-5	5.8 E-6	1.5 E-5	4.0 E-5
Ethylbenzene	2.76	5.9 E+3	4.7 E-4	8.9 E-6	0.10	2.7 E-6	3.2 E-4	1.0 E-1	1.0 E-1	1.0 E+0	8.9 E-5	2.7 E-5	3.2 E-4	4.4 E-4
Total Xylenes	12	6.4 E+3	1.9 E-3	3.9 E-5	0.10	1.2 E-5	1.3 E-3	2.0 E-1	2.0 E-1	1.0 E-1	1.9 E-4	5.8 E-5	1.3 E-2	1.3 E-2
n-Butylbenzene	0.11	1.2 E+4	8.9 E-6	3.6 E-7	0.10	1.1 E-7	6.1 E-6	4.0 E-2	4.0 E-2	1.4 E-1	8.9 E-6	2.7 E-6	4.4 E-5	5.5 E-5
sec-Butylbenzene	0.04	9.0 E+3	4.0 E-6	1.2 E-7	0.10	3.5 E-8	2.7 E-6	4.0 E-2	4.0 E-2	1.4 E-1	2.9 E-6	8.7 E-7	2.0 E-5	2.3 E-5
Isopropylbenzene	0.07	4.1 E+3	1.6 E-5	2.1 E-7	0.10	6.4 E-8	1.1 E-5	1.0 E-1	1.0 E-1	3.9 E-1	2.1 E-6	6.4 E-7	2.9 E-5	3.2 E-5
p-Isopropyltoluene	0.02	4.1 E+3	4.9 E-6	6.5 E-8	0.10	1.9 E-8	3.4 E-6	NA	NA	NA	NC	NC	NC	NC
Methylene Chloride	0.02	2.8 E+3	8.5 E-6	7.7 E-8	0.10	2.3 E-8	5.9 E-6	6.0 E-2	6.0 E-2	4.0 E-1	1.3 E-6	3.9 E-7	1.5 E-5	1.6 E-5
Naphthalene	0.18	4.7 E+4	3.8 E-6	5.8 E-7	0.10	1.7 E-7	2.6 E-6	2.0 E-2	2.0 E-2	3.0 E-3	2.9 E-5	8.7 E-6	8.8 E-4	9.1 E-4
n-Propylbenzene	0.20	1.4 E+4	1.5 E-5	6.5 E-7	0.10	1.9 E-7	1.0 E-5	1.0 E-1	1.0 E-1	3.9 E-1	6.5 E-6	1.9 E-6	2.6 E-5	3.4 E-5
1,3,5-Trimethylbenzene	0.23	8.7 E+3	2.6 E-5	7.4 E-7	0.10	2.2 E-7	1.8 E-5	5.0 E-2	5.0 E-2	6.0 E-3	1.5 E-5	4.5 E-6	3.0 E-3	3.1 E-3
1,2,4-Trimethylbenzene	1.30	2.2 E+4	6.0 E-5	4.2 E-6	0.10	1.3 E-6	4.1 E-5	5.0 E-2	5.0 E-2	6.0 E-3	8.4 E-5	2.5 E-5	7.0 E-3	7.1 E-3
									Total Hazard Index		**0.027**	**0.0080**	**0.25**	**0.29**

Cs = Concentration of chemical in soil
SEDo = Soil exposure dose, oral route
SEDd = Soil exposure dose, dermal route
ExCi = Exposure concentration, inhalation route
NA = Not available.
NC = Not calculated.

CSFo = Cancer Slope Factor, Oral $(mg/kg\text{-}day)^{-1}$
CSFd = Cancer Slope Factor, Dermal $(mg/kg\text{-}day)^{-1}$
URF = Unit Risk Factor, $(mg/m^3)^{-1}$
RfDo = Reference Dose, Oral (mg/kg-day)
RfDd = Reference Dose, Dermal (mg/kg-day)
RfC = Reference Concentration (mg/m^3)

Table 19
Risk Assessment Results – Construction Worker - Groundwater
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Concentration Groundwater Cs (ug/L)	Concentration Air Ca (mg/m^3)	Dermal Absorption DAevent (cm/event)	Dermal ADD/LADD (SExDd) (mg/kg-day)	Inhalation (ExCi) (mg/m^3)	Toxicity Values Dermal	Toxicity Values Inhalation	Dermal Risk/HI	Inhalation Risk/HI	Total Risk/HI
CANCER EFFECTS						CSFd	URF			
TPH-Mo	450,000									
C19-C36 Aliphatics	450,000	NA	NA	NC	NC	NA	NA	NC	NC	NC
TPH-D	300,000									
C11-C22 Aromatics	300,000	8.8 E-3	0.91	4.5 E-3	8.6 E-5	NA	NA	NC	NC	NC
C9-C18 Aliphatics	NA	NA	3.84	NC	NC	NA	NA	NC	NC	NC
TPH-G	1,300,000									
C9-C10 Aromatics	1,300,000	4.2 E-1	0.65	1.4 E-2	4.1 E-3	NA	NA	NC	NC	NC
Benzene	870	2.5 E-4	0.02	3.5 E-7	2.4 E-6	1.0 E-1	2.9 E-5	3 E-8	7 E-8	1 E-7
Toluene	294	9.7 E-5	0.05	2.6 E-7	9.5 E-7	NA	NA	NC	NC	NC
Ethylbenzene	7,000	2.4 E-3	0.09	1.0 E-5	2.3 E-5	NA	NA	NC	NC	NC
Total Xylenes	3,507	1.0 E-3	0.09	5.5 E-6	1.0 E-5	NA	NA	NC	NC	NC
n-Butylbenzene	1,600	4.5 E-4	0.76	2.0 E-5	4.4 E-6	NA	NA	NC	NC	NC
sec-Butylbenzene	450	1.8 E-4	0.70	5.2 E-6	1.8 E-6	NA	NA	NC	NC	NC
Isopropylbenzene	1,100	2.5 E-4	0.44	8.0 E-6	2.4 E-6	NA	NA	NC	NC	NC
p-Isopropyltoluene	350	7.9 E-5	0.44	2.6 E-6	7.8 E-7	NA	NA	NC	NC	NC
Naphthalene	2,500	2.0 E-5	0.10	4.0 E-6	2.0 E-7	NA	NA	NC	NC	NC
n-Propylbenzene	2,700	6.1 E-4	0.76	3.4 E-5	6.0 E-6	NA	NA	NC	NC	NC
1,3,5-Trimethylbenzene	1,600	2.7 E-4	0.66	1.8 E-5	2.6 E-6	NA	NA	NC	NC	NC
1,2,4-Trimethylbenzene	7,700	9.3 E-4	0.80	1.0 E-4	9.1 E-6	NA	NA	NC	NC	NC
						Total Cancer Risk		**3 E-8**	**7 E-8**	**1 E-7**

Table 19
Risk Assessment Results – Construction Worker - Groundwater
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Concentration Groundwater Cs (ug/L)	Air Ca (mg/m^3)	Dermal Absorption DAevent (cm/event)	Dermal ADD/LADD (SExDd) (mg/kg-day)	Inhalation (ExCi) (mg/m^3)	Toxicity Values Dermal	Toxicity Values Inhalation	Dermal Risk/HI	Inhalation Risk/HI	Total Risk/HI
NON-CANCER EFFECTS						RfDd	RfC			
TPH-Mo	450,000									
C19-C36 Aliphatics	450,000	NA	NA	NC	NC	2.0 E+0	NA	NC	NC	NC
TPH-D	300,000									
C11-C22 Aromatics	300,000	8.8 E-3	0.91	3.2 E-1	6.1 E-3	3.0 E-2	5.0 E-2	1.1 E+1	1.2 E-1	1.1 E+1
C9-C18 Aliphatics	NA	NA	3.84	NC	NC	1.0 E-1	2.0 E-1	NC	NC	NC
TPH-G	1,300,000									
C9-C10 Aromatics	1,300,000	4.2 E-1	0.65	9.8 E-1	2.9 E-1	3.0 E-2	5.0 E-2	3.3 E+1	5.8 E+0	3.9 E+1
Benzene	870	2.5 E-4	0.02	2.4 E-5	1.7 E-4	4.0 E-3	3.0 E-2	6.0 E-3	5.6 E-3	1.2 E-2
Toluene	294	9.7 E-5	0.05	1.8 E-5	6.7 E-5	8.0 E-2	5.0 E+0	2.3 E-4	1.3 E-5	2.4 E-4
Ethylbenzene	7,000	2.4 E-3	0.09	7.1 E-4	1.6 E-3	1.0 E-1	1.0 E+0	7.1 E-3	1.6 E-3	8.8 E-3
Total Xylenes	3,507	1.0 E-3	0.09	3.9 E-4	7.1 E-4	2.0 E-1	1.0 E-1	1.9 E-3	7.1 E-3	9.0 E-3
n-Butylbenzene	1,600	4.5 E-4	0.76	1.4 E-3	3.1 E-4	4.0 E-2	1.4 E-1	3.5 E-2	2.2 E-3	3.7 E-2
sec-Butylbenzene	450	1.8 E-4	0.70	3.7 E-4	1.2 E-4	4.0 E-2	1.4 E-1	9.2 E-3	8.9 E-4	1.0 E-2
Isopropylbenzene	1,100	2.5 E-4	0.44	5.6 E-4	1.7 E-4	1.0 E-1	3.9 E-1	5.6 E-3	4.4 E-4	6.1 E-3
p-Isopropyltoluene	350	7.9 E-5	0.44	1.8 E-4	5.4 E-5	NA	NA	NC	NC	NC
Naphthalene	2,500	2.0 E-5	0.10	2.8 E-4	1.4 E-5	2.0 E-2	3.0 E-3	1.4 E-2	4.7 E-3	1.9 E-2
n-Propylbenzene	2,700	6.1 E-4	0.76	2.4 E-3	4.2 E-4	1.0 E-1	3.9 E-1	2.4 E-2	1.1 E-3	2.5 E-2
1,3,5-Trimethylbenzene	1,600	2.7 E-4	0.66	1.2 E-3	1.8 E-4	5.0 E-2	6.0 E-3	2.5 E-2	3.1 E-2	5.5 E-2
1,2,4-Trimethylbenzene	7,700	9.3 E-4	0.80	7.2 E-3	6.4 E-4	5.0 E-2	6.0 E-3	1.4 E-1	1.1 E-1	2.5 E-1
						Total Hazard Index		**44**	**6.1**	**50**

Cs = Concentration of chemical in soil
SExDo = Soil exposure dose, oral route
SExDd = Soil exposure dose, dermal route
ExCi = Exposure concentration, inhalation route
NA = Not available.
NC = Not calculated.

CSFo = Cancer Slope Factor, Oral $(mg/kg\text{-}day)^{-1}$
CSFd = Cancer Slope Factor, Dermal $(mg/kg\text{-}day)^{-1}$
URF = Unit Risk Factor, $(mg/m^3)^{-1}$
RfDo = Reference Dose, Oral (mg/kg-day)
RfDd = Reference Dose, Dermal (mg/kg-day)
RfC = Reference Concentration (mg/m^3)

Table 20
Toxicity Criteria
Napa Lodgeworks Property
Franklin and First Streets

Chemical	Oral	Dermal		Inhalation	
	Toxicity Values				
CANCER EFFECTS					
	CSFo	CSFd		URF	
TPH-Gasoline (TPH-G)					
C9-C10 Aromatics	NA	NA		NA	
TPH-Mo					
C19-C36 Aliphatics	NA	NA		NA	
TPH-D					
C11-C22 Aromatics	NA	NA		NA	
C9-C18 Aliphatics	NA	NA		NA	
Benzene	1.0 E-1	1.0 E-1	a	2.9 E-5	a
Toluene	NA	NA		NA	
Ethylbenzene	NA	NA		NA	
Total Xylenes	NA	NA		NA	
o-Xylene	NA	NA		NA	
1,2,4-Trimethylbenzene	NA	NA		NA	
1,3,5-Trimethylbenzene	NA	NA		NA	
m,p-Xylene	NA	NA		NA	
Tetrachloroethene	N/A	N/A		5.9 E-6	a
Trichloroethene	N/A	N/A		2.0 E-6	a
Propylbenzene	NA	NA		NA	
n-Butylbenzene	NA	NA		NA	
sec-Butylbenzene	NA	NA		NA	
Isopropylbenzene	NA	NA		NA	
p-Isopropyltoluene	NA	NA		NA	
Methylene Chloride	1.4 E-2	1.4 E-2	a	1.0 E-6	a
Naphthalene	NA	NA		NA	
n-Propylbenzene	NA	NA		NA	

Table 20
Toxicity Criteria
Napa Lodgeworks Property
Franklin and First Streets

Chemical		Toxicity Values				
		Oral	**Dermal**		**Inhalation**	
NON-CANCER EFFECTS						
		RfDo	RfDd		RfC	
TPH-Gasoline (TPH-G)[b]						
	C9-C10 Aromatics	3.0 E-2	3.0 E-2	b	5.0 E-2	b
TPH-Mo						
	C19-C36 Aliphatics	2.0 E+0	2.0 E+0	b	NA	b
TPH-D						
	C11-C22 Aromatics	3.0 E-2	3.0 E-2	b	5.0 E-2	b
	C9-C18 Aliphatics	1.0 E-1	1.0 E-1	b	2.0 E-1	b
Benzene		4.0 E-3	4.0 E-3	c	3.0 E-2	c
Toluene		8.0 E-2	8.0 E-2	c	5.0 E+0	a
Ethylbenzene		1.0 E-1	1.0 E-1	c	1.0 E+0	a
Total Xylenes		2.0 E-1	2.0 E-1	c	1.0 E-1	c
o-Xylene		2.0 E-1	2.0 E-1	c	1.0 E-1	c
1,2,4-Trimethylbenzene		5.0 E-2	5.0 E-2	d	6.0 E-3	d
1,3,5-Trimethylbenzene		5.0 E-2	5.0 E-2	d	6.0 E-3	d
Propylbenzene		4.0 E-2	4.0 E-2	d	1.4 E-1	d
n-Butylbenzene		4.0 E-2	4.0 E-2	d	1.4 E-1	d
sec-Butylbenzene		4.0 E-2	4.0 E-2	d	1.4 E-1	d
Isopropylbenzene		1.0 E-1	1.0 E-1	c	3.9 E-1	c
p-Isopropyltoluene		NA	NA		NA	
Methylene Chloride		6.0 E-2	6.0 E-2	c	4.0 E-1	a
Naphthalene		2.0 E-2	2.0 E-2	c	3.0 E-3	c
n-Propylbenzene		1.0 E-1	1.0 E-1	c	3.9 E-1	c

[a] OEHHA (2007)
[b] MaDEP (2003)
[c] USEPA (2007)
[d] USEPA (2004)

CSFo	Cancer Slope Factor, Oral $(mg/kg\text{-}day)^{-1}$
CSFd	Cancer Slope Factor, Dermal $(mg/kg\text{-}day)^{-1}$
URF	Unit Risk Factor, $(mg/m^3)^{-1}$
RfDo	Reference Dose, Oral (mg/kg-day)
RfDd	Reference Dose, Dermal (mg/kg-day)
RfC	Reference Concentration (mg/m^3)
NA	Not available
N/A	Not applicable

Table 21
Risk Assessment Results - Summary
Napa Lodgeworks Property
Franklin and First Streets

	Soil								**Groundwater**						**Total**	
	Ingestion		Dermal		Inhalation		Media Total		Vapor Inhalation		Dermal Contact		Media Total			
	HI	ILCR	HI	ILCR	HI	ILCR	HI	ILCR	HI	ILCR	HI	ILCR	HI	ILCR	HI	ILCR
Outdoor (Maintenance) Worker	0.0080	4 E-8	0.0053	2 E-8	0.25	2 E-6	0.26	2 E-6	6.0	2 E-6	NA	NA	6.0	2 E-6	6.3	4 E-6
Future Indoor (Hotel) Worker	0.0040	2 E-8	NC	NC	0.93	2 E-6	0.94	2 E-6	1.9	8 E-6	NA	NA	1.9	8 E-6	2.8	1 E-5
Future Construction Worker	0.03	5 E-9	0.008	1 E-9	0.25	1 E-7	0.29	1 E-7	6.1	7 E-8	44	3 E-8	50	1 E-7	50	2 E-7

HI = Hazard Index
ILCR = Incremental lifetime cancer risk

Table 22
On-Site Soil RBCs
Napa Lodgeworks Property
Franklin and First Streets

Chemical	EPC	Hazard	Risk	RBC HQ = 0.5	HQ = 1	Risk = 10^{-6}
0-10 feet bgs						
Outdoor (Maintenance) Worker		**0.26**	**2 E-6**			
Benzene	1.00	0.008	2 E-6	NA	NA	0.41
Future Indoor (Hotel) Worker		**0.94**	**2 E-6**			
Benzene	1.00	0.007	2 E-6	NA	NA	0.46

bgs = below ground surface.
All concentrations are expressed in milligrams per kilogram (mg/kg)

Table 23
On-Site Groundwater RBCs
Napa Lodgeworks Property
Franklin and First Streets

				RBC		
Chemical	**EPC**	**Hazard**	**Risk**	**HQ = 0.5**	**HQ = 1**	**Risk = 10^{-6}**
Outdoor (Maintenance) Worker		**6.0**	**2 E-6**			
TPH-Gasoline (TPH-G)	1,300,000					
C9-C10 Aromatics	1,300,000	5.8	NC	112,650	225,299	NA
Benzene	870	0.0056	2 E-6	NA	NA	497
Indoor (Hotel) Worker		**1.9**	**8 E-6**			
TPH-Gasoline (TPH-G)	1,300,000					
C9-C10 Aromatics	1,300,000	0.85	NC	30,000	51,000[a]	NA
TPH-Motor Oil (TPH-MO)	450,000					
C19-C36 Aliphatics	450,000	NC	NC	NA	NA	NA
TPH-Diesel (TPH-D)	300,000					
C11-C22 Aromatics	300,000	0.010	NC	NA	NA	NA
Benzene	870	0.025	8 E-6	NA	NA	112
Toluene	294	0.000056	NC	NA	NA	NA
Ethylbenzene	7,000	0.0065	NC	NA	NA	NA
Total Xylenes	3,507	0.025	NC	NA	NA	NA
n-Butylbenzene	1,600	0.012	NC	NA	NA	NA
sec-Butylbenzene	450	0.00014	NC	NA	NA	NA
Isopropylbenzene	1,100	0.0038	NC	NA	NA	NA
p-Isopropyltoluene	350	NC	NC	NA	NA	NA
Naphthalene	2,500	0.057	NC	NA	NA	NA
n-Propylbenzene	2,700	0.0067	NC	NA	NA	NA
1,3,5-Trimethylbenzene	1,600	0.14	NC	NA	NA	NA
1,2,4-Trimethylbenzene	7,700	0.73	NC	5,292	10,584	NA
Construction Worker		**50**	**1 E-7**			
TPH-Gasoline (TPH-G)	1,300,000					
C9-C10 Aromatics	1,300,000	39	NA	16,871	33,743	NA
TPH-Motor Oil (TPH-MO)	450,000					
C19-C36 Aliphatics	450,000	NC	NA	NA	NA	NA
TPH-Diesel (TPH-D)	300,000					
C11-C22 Aromatics	300,000	11	NA	13,978	27,955	NA
Benzene	870	0.012	NA	NA	NA	NA
Toluene	294	0.0002	NA	NA	NA	NA
Ethylbenzene	7,000	0.0088	NA	NA	NA	NA
Total Xylenes	3,507	0.0090	NA	NA	NA	NA
n-Butylbenzene	1,600	0.037	NA	NA	NA	NA
sec-Butylbenzene	450	0.0101	NA	NA	NA	NA
Isopropylbenzene	1,100	0.0061	NA	NA	NA	NA
p-Isopropyltoluene	350	NC	NA	NA	NA	NA
Naphthalene	2,500	0.019	NA	NA	NA	NA
n-Propylbenzene	2,700	0.025	NA	NA	NA	NA
1,3,5-Trimethylbenzene	1,600	0.055	NA	NA	NA	NA
1,2,4-Trimethylbenzene	7,700	0.25	NA	NA	NA	NA

All concentrations are expressed in micrograms per liter (ug/L)

[a] Set at the solubility limit since the maximum detected concentration exceeds the solubility but does not result in an estimated health risk that exceeds an acceptable metric.

APPENDIX B

APPENDIX B

GENERALIZED ENVIRONMENTAL HEALTH AND SAFETY PLAN
SOIL AND GROUNDWATER REMEDIATION
INN AT TOWN CENTER
1400 FIRST STREET
NAPA, CALIFORNIA

Raney Reference No. 2952-001.02

Plan Prepared By: Raney Geotechnical, Inc. Date: 31 May 2007

Introduction/Objective: We have prepared this *Generalized Environmental Health and Safety Plan* for the proposed remedial activities at the subject site. This document presents general environmental safety measures to be undertaken during the remedial work. Development of general health and safety measures, such as those to address common physical, noise, and construction hazards are the responsibility of the contractor and are not included in the scope of this plan.

Site Location and Description: The subject property is located within a commercial area of downtown Napa, California. The approximate 0.75-acre site is generally bounded by Franklin Street to the east, by First Street to the south, by commercial property to the west, and by a City parking garage to the north. The site is currently vacant and unused.

Project Description: This project includes the excavation of petroleum hydrocarbon contaminated soils and the removal of groundwater by pumping from the excavation. A detailed description of the remedial activities is presented in our *Remedial Action Workplan* dated May 31, 2007.

Potential Chemical Hazards: A low-level hazard exists for exposure to petroleum hydrocarbon vapors, and petroleum contaminated soils and groundwater during the remedial activities. Exposure routes include inhalation, dermal contact, and ingestion.

Environmental Safety Measures

Site Orientation Meeting: Prior to initiation of the remedial activities, workers shall attend an on-site safety meeting to discuss the required safety measures described herein. Copies of this plan will be provided for each worker involved with the remedial activities at the project site, or prior to arrival.

Hazard Evaluation and Monitoring: Our representative will assist in evaluating the chemical safety hazard during the planned remedial activities. Monitoring will include visual and olfactory observations and Photoionization Detector (PID) measurements. Appropriate action in the form of environmental health and safety plan modifications will be initiated if warranted.

A limit of 100 parts per million vapor (ppmv) total hydrocarbons at the breathing zone is proposed as the maximum acceptable hydrocarbon level of exposure without respiratory protection. A PID meter will be used to measure total hydrocarbon levels at various locations at the project site. The PID is a direct reading real-time analyzer that is capable of detecting most of the volatile hydrocarbon constituents present in a vapor phase. In a typical situation, with one percent of the hydrocarbon vapors being benzene, a 50 ppmv concentration of total hydrocarbon would result in a breathing zone level of 0.5 pmv benzene. This level is one half of the current Permissible Exposure Limit (PEL) of one part per million (ppm) for an eight-hour occupational exposure to benzene.

Personal Protective Equipment (Level D): Based on the work to be performed and type of chemical hazards that may be encountered, Environmental Protection Agency (EPA) Level D personal protection equipment (PPE) has been determined to be suitable for the tasks in this project. EPA Level D PPE does not provide respiratory protection, but does provide minimal dermal protection. Minimum PPE requirements can be upgraded or downgraded if site conditions warrant. The minimum modified Level D PPE for this plan should consist of the following:

- Sturdy boots or shoes
- Appropriate garments for climate conditions, with the exception that long pants must be worn
- Appropriate eye wear for climate and on-site conditions
- Nitrile rubber gloves

If a worker's clothing becomes saturated with an obviously contaminated liquid/sludge the possibility for dermal exposure to contaminants may exist. Under these circumstances, that worker will change out of the contaminated clothing, clean off any residual liquid/sludge with water and change into clean clothing. Tyvek coveralls will be available and provided if warranted.

Potential Fire/Explosion Hazard: Although explosive conditions are not anticipated, explosive vapor conditions will be monitored by our field representative. Lower explosive limit (LEL) measurements will be taken using the PID and documented. The LEL for gasoline hydrocarbons is approximately 1.4 percent in air. Using a ten-fold safety factor, a working criteria of 1,400 ppm (ten percent LEL) as measured by a PID is established for explosion hazards. When measurements obtained near the excavations reveal this concentration, or above, work will be stopped. Additionally, the field crew will be instructed to stay upwind until these concentrations diminish.

Decontamination Procedures: Due to the volatile nature of the petroleum hydrocarbons that may be encountered during the remedial activities, decontamination of equipment and vehicles will be of minimal importance since the volatile hydrocarbons will rapidly vaporize. However, equipment exposed to contaminated soil and groundwater should not leave the project site until it is rinsed. Rinseate and soil residue generated during equipment washing should be handled as directed by our representative.

All personnel in contact with the soil and groundwater during remedial activities will be instructed to wash their hands, face, neck, and arms at the end of the work day. No eating, drinking, smoking, or chewing of gum or tobacco will be permitted in the work area.

Emergency Information:

Ambulance: 911
Hospital/Occupational Health Center: (707) 253-5000
Police: 911
Fire Department: 911
Explosives Unit: 911
Agency Contact: National Response Center (NAC)
Toxic Chemical and Oil Spills
(1-800-424-8802)

Napa State Hospital
2100 Napa Vallejo Hwy.
Napa, CA 94558

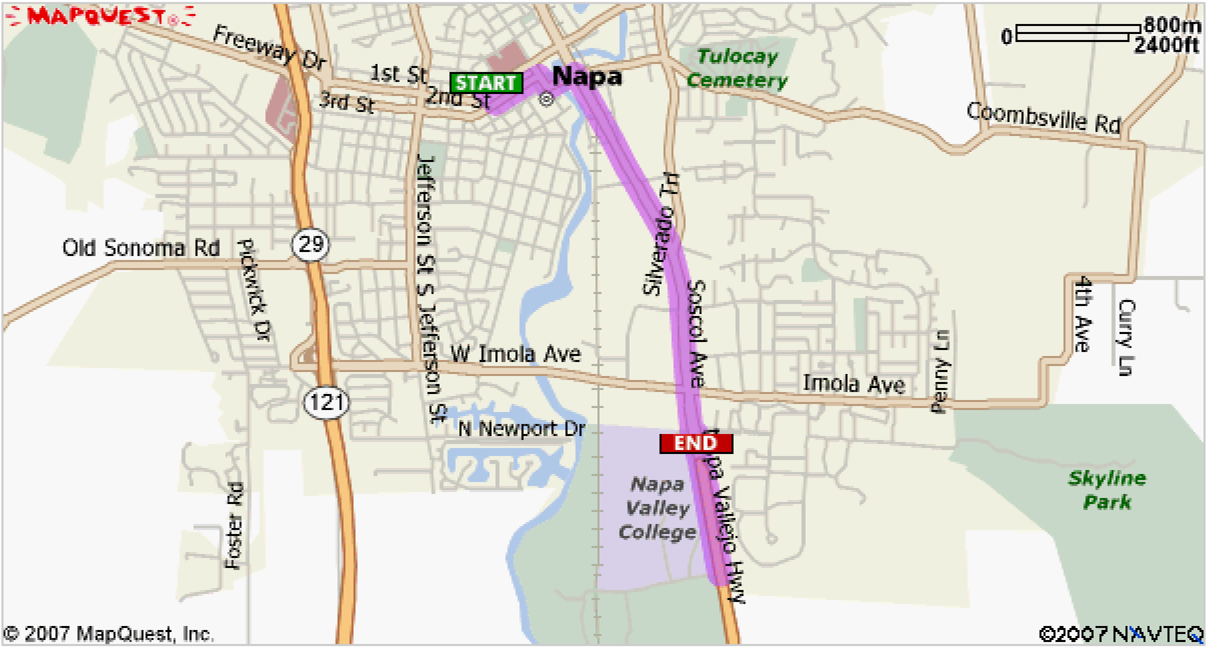
Directions to Hospital: See attached map.

Start: **1400 1st St**
Napa, CA 94559-2843, US

End: **NAPA State Hospital:**
707-253-5000
2100 Napa Vallejo Hwy, Napa, CA
94558, US

Notes:

	Directions	Distance
	Total Est. Time: 7 minutes **Total Est. Distance:** 3.11 miles	
START	**1:** Start out going SOUTHEAST on FRANKLIN ST toward 2ND ST.	<0.1 miles
	2: Turn LEFT onto 2ND ST.	0.2 miles
	3: Turn RIGHT onto MAIN ST.	<0.1 miles
	4: Turn LEFT onto 3RD ST.	0.1 miles
	5: Turn RIGHT onto SOSCOL AVE.	1.3 miles
SOUTH 221	**6:** SOSCOL AVE becomes NAPA VALLEJO HWY / CA-221 S.	0.7 miles
NORTH 221	**7:** Make a U-TURN at STREBLOW DR onto NAPA VALLEJO HWY / CA-221 N.	0.5 miles
END	**8:** End at **NAPA State Hospital:** 2100 Napa Vallejo Hwy, Napa, CA 94558, US	
	Total Est. Time: 7 minutes **Total Est. Distance:** 3.11 miles	



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